World Petroleum

24th Annual Refinery Issue

$5.00 PER YEAR
$1.00 PER COPY

AND *Now*

On the West Coast, too...

we will have

NATURAL GASOLINE

available in quantity

at our NEW Deepwater Terminal

near

San Pedro, California

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN
TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS

101 Tanks for Aden

The above view shows a part of the area at Aden where CB&I erection crews are building 101 Horton welded steel plate tanks.

In Aden, a small country south of Saudi Arabia, Chicago Bridge & Iron Company erection crews are building 101 cone roof and Horton Floating Roof tanks. These storage tanks are a part of a 100,000-bbl.-a-day refinery under construction for the Anglo-Iranian Oil Company by the Bechtel Corporation.

The refinery is located at Little Aden, 6 miles across the bay from Aden proper. It is the largest individual refinery now being built in the British Commonwealth and will be on stream in 1955.

Products from the refinery will be pumped to the tank farm for storage. The tanks storing motor gasoline, kerosene and crude oil will be equipped with Horton Floating Roofs.

Chicago Bridge & Iron Company's welded steel plate storage and processing equipment has helped the petroleum industry keep pace with the ever growing demand for its products. Throughout the industry, Horton Floating Roofs, Hortonspheres, Hortonspheroids, refinery towers and other refinery equipment are daily boosting production and setting ever higher standards of operating efficiency.

When planning welded steel plate structures of any sort, for new refineries or old, write our nearest office for information, estimates or quotations. There is no obligation on your part.

CHICAGO BRIDGE & IRON COMPANY

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Los Angeles • Philadelphia • Pittsburgh • Salt Lake City • San Francisco • Seattle • Tulsa
Plants: Birmingham, Chicago, Salt Lake City and Greenville, Pa., U.S.A.
Export Office — 165 Broadway Building, New York 6, N.Y., U.S.A.

REPRESENTATIVES AND LICENSEES

Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Comprimo N.V., 21, Amstel Amsterdam (C) Netherlands
Compagnia Tecnica Industrie Petroli, Rome, Italy
Chicago Bridge & Iron Company, Ltd., Apartado 1348 Caracas, Venezuela
Whessoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Horton Steel Works Limited, Fort Erie, Ontario, Canada
W. P. Bryant, Edifico Abreu 402, Havana, Cuba
Sociedade Chibridge de Construcoes Ltda., Av. General Justo, 275, Grupo 306, Rio de Janeiro, Brazil

Fractions SOLVE BIG PROBLEMS

The petroleum industry has made good use of the "divide-and-rule" formula that conquered kingdoms . . . to win command of the giant powers hidden in nature's oil. The industry's process engineers have transformed American life by their mastery of petroleum's secrets . . . and fractionating has been their master key.

These engineers' ability to develop processes which break petroleum into its component fractions has harnessed the "black gold" into a myriad forms of service. There have been other important results, too. The gigantic motor industry . . . America's vast network of modern highways . . . the services to motor travel—these are largely by-products of the petroleum process engineer's knowledge of fractional distillation.

For many years, Sun Ship has been adding to its own prestige by the service and cooperation its great shops give to the petroleum industry, and to the many other industries which call on Sun Ship's versatile engineering and construction skills. It has built . . . for chemical and petroleum process engineers, and for refineries throughout the world . . . the immense fractionating towers, pressure vessels, special machinery and heavy equipment they require. The 95′7″ crude tower shown in the photograph, ready for shipment, is a representative example.

Sun Ship's services will continue to keep pace with the giant strides made by the nation's industries in the engineering progress which is steadily building a greater America.

Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE SINCE 1916 **CHESTER, PA.**

25 BROADWAY • NEW YORK CITY

WORLD PETROLEUM for July 15, 1954, Vol. 25, No. 8, July 15, 1954. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, 604 Fifth Ave., New York 20, N. Y. Authorized as Second Class Matter, P.O. Dept., Ottawa, Canada. Subscription rate: $5.00 per year, single copies $1.00. Copyright 1954, by Mona Palmer, Trustee.

Nahir

DRIVES THE BIG ONES

Khaliyfah ibn Nahir is a skilled driver. He is confident of his ability to handle a big 300 h.p. truck on off-road oil exploration trips in Saudi Arabia. Nahir was trained long and carefully by the Arabian American Oil Company. Now, as a lead driver of an ARAMCO structure drill party, he gets the chance to put his know-how to use.

ARABIAN AMERICAN OIL COMPANY

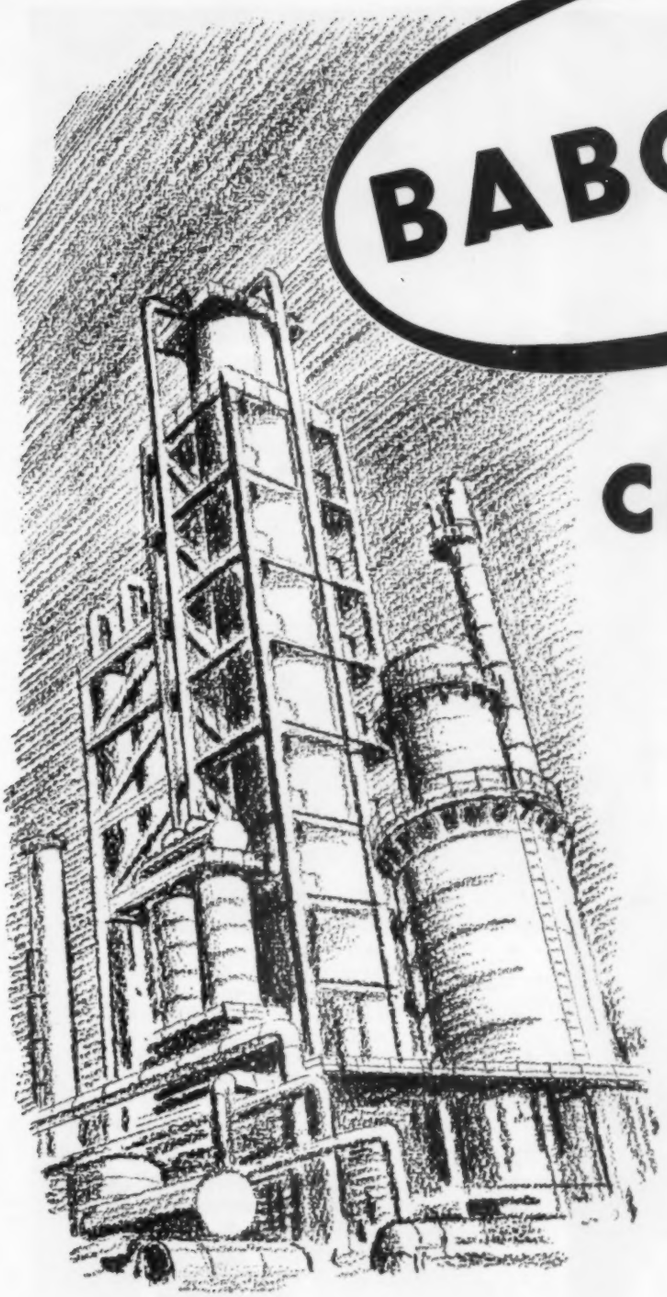
DHAHRAN, SAUDI ARABIA — NEW YORK, U.S.A.

Unique

"Newallastic" bolts and studs have qualities which are absolutely unique. They have been tested by every known device, and have been proved to be stronger and more resistant to fatigue than bolts or studs made by the usual method.

C. P. Newall & Co., Ltd.

POSSILPARK GLASGOW · N



BABCOCK

at

CORYTON

Babcock & Wilcox Ltd. are playing a vital part in the provision of British-made equipment for Britain's new oil refineries. Their contribution to the new Coryton refinery is a major one, comprising *98 pressure vessels and 30 vertical columns*, for incorporation in the furfural, propane, deasphalting, M.E.K., distillation, percolation and T.C.C. units, and in connection with gasolene treatment, yard piping air supply, propane tankage, thermal reformation and boiler plant. The T.C.C. unit includes a Reactor weighing 60 tons, in size, 47 ft. by 13 ft., fabricated from "Colclad"—alloy-clad steel. Total weight of all these items is over 800 tons; and the vertical columns range in height up to 92 ft.

BABCOCK & WILCOX LTD

BABCOCK HOUSE, FARRINGDON STREET, LONDON, E.C.4., ENGLAND

Makers of **COMPLETE STEAM RAISING PLANTS, HEAT EXCHANGERS, WELDED PRESSURE VESSELS, MECHANICAL HANDLING EQUIPMENT**

ENGLAND—Another Caltex tanker slips down the ways to join her sister ships in transporting vital crude oil and finished petroleum products to ports and markets of the free world. In commissioning these tankers and training their crews, Caltex gives employment opportunities to many . . . helps strengthen England's economy.

INDIA—During the Indian Railways Centenary Exhibition in 1953, visitors to the Caltex stall were impressed with exhibits and literature showing 100 years of railroad development in India. Today, Caltex railroad lubricants and fuels play an important part in maintaining better freight and passenger service . . . assure dependable operation, lower maintenance costs.

EGYPT—Transportation facilities in the principal cities of the "Land of the Pharaohs" are strictly up to date. To motorists and fleet owners, modern Caltex service stations—like this one in Cairo—offer the latest in automotive products . . . and the efficient service that brings back old customers and attracts a constant flow of new friends.

Caltex serves the people of 67 lands

In 67 lands, across half the world, through such developments as these, Caltex is able to supply better fuels and lubricants for industry, for agriculture, and for motoring millions. These require a continual investment of funds and skills, backed by a faith in a better future for free nations.

CALTEX

meeting

CALTEX

Petroleum Products

SERVING EUROPE • AFRICA • ASIA • AUSTRALASIA

The secret of flying a B-36

The Strategic Air Command tells us the average age of the First Pilot on a B-36 is 32 years. (This would have made him an old man among World War II fliers.) He ranks captain, major, or better. And he has an average of 3,800 hours' air time to his credit in multi-engine aircraft. The "secret" of flying a B-36 is the good judgment that comes only from experience.

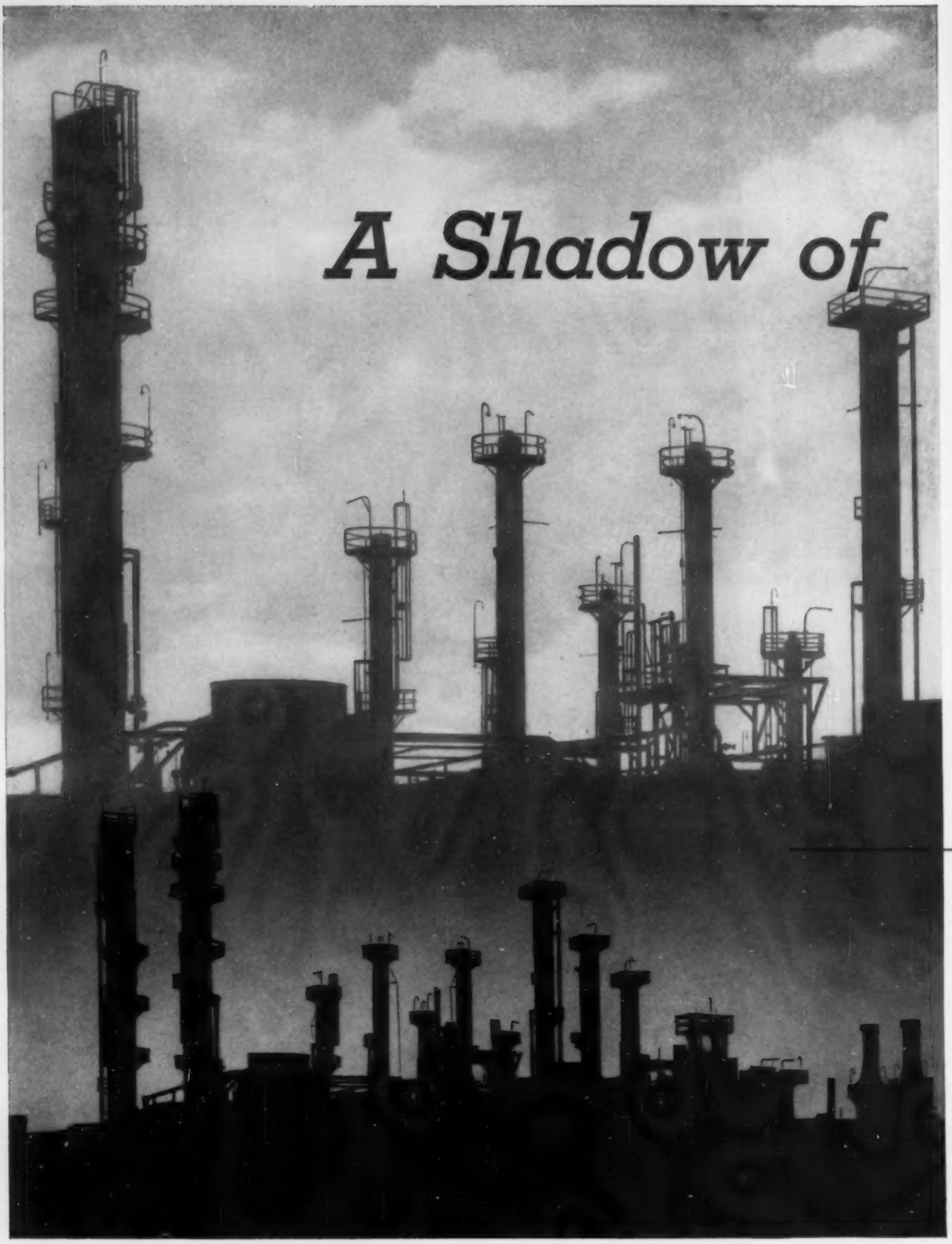
In this respect, we think it's interesting to note the similarity of flying such an aircraft to working on the intricate problems of relating fuels to engines. Here, too, there is simply no substitute for years of intensive and specialized experience.

That's why we think you will be interested to know that the key men in charge of engine-fuel studies at Ethyl have an average of 19 years' experience in their individual specialties. When they engage in any co-operative work or consultation with you, they draw on a rich background of thousands of hours of laboratory work and millions of miles of road tests. And, as an organization, Ethyl Research Laboratories have worked closely with the petroleum and automotive industries for 31 years.

These years of experience give Ethyl a special insight into the complex problems of relating engines, fuels and lubricants . . . an insight we believe adds considerably to the value of "Ethyl" antiknock service.

ETHYL CORPORATION, New York 17, N. Y.

Ethyl Antiknock Ltd., in Canada


A Shadow of

Things Yet to Come

A great deal has happened since the inception of this company four years ago. It has been a time of exceptional growth, progress, achievement.

The broad range of work undertaken includes the simple and the complex . . . complete refineries and auxiliary units . . . crude units and office buildings . . . turnaround operations and laboratories. And the field of operation has expanded to become international in scope, with "Built by Procon" a well-known term even in the more remote parts of the world.

We are proud of the men in our organization whose talents, experience and unbounded energy have made these achievements possible.

But we are even more conscious of, and grateful for, the confidence placed in us which, from the very start, has been so clearly evidenced by all those whom we have served.

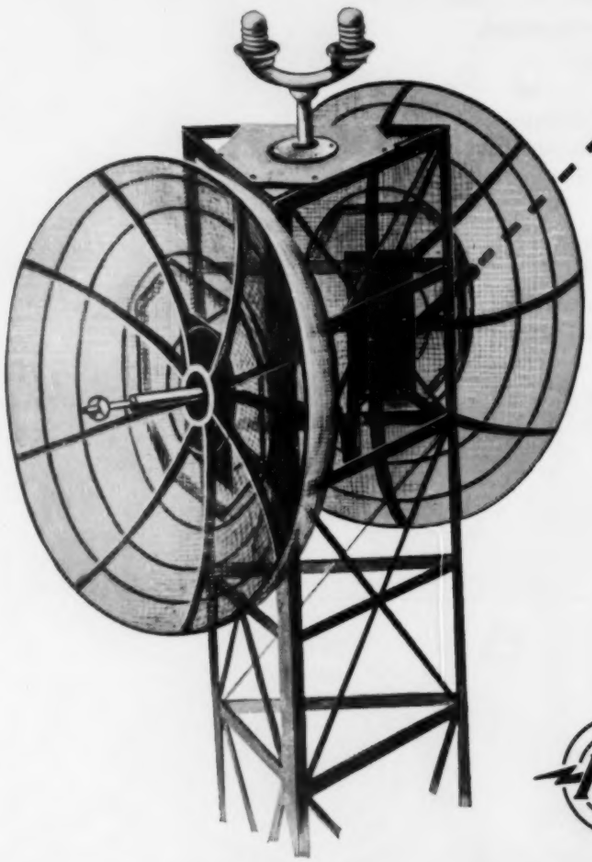
The accomplishments of these past four years . . . great as they seem to this young business . . . will, we are confident, prove to be but a shadow of things yet to come.

PROCON *Incorporated*
PROCESS CONSTRUCTION
1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U. S. A.

IN CANADA | PROCON (CANADA) LIMITED
40 ADVANCE ROAD
TORONTO 18, ONTARIO

IN ENGLAND | PROCON (GREAT BRITAIN) LIMITED
112 STRAND, LONDON, W. C. 2

...the communication system of the future for LATIN AMERICA



Ready today through ISE

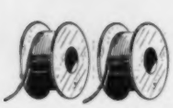
Microwave radio relay systems are revolutionizing communications—by eliminating wire lines. Microwave provides dependable communication between points separated by jungles, forests, waterways, and mountainous areas—and *stays in service* regardless of the storms that so often play havoc with wire circuits. Developed originally by International Telephone and Telegraph Corporation, microwave in its most advanced form is available now through ISE, an IT&T associate. Look to ISE for the finest in microwave—for the finest in communications equipment of every kind.

ISE — an IT&T associate

International Standard Electric Corporation

67 Broad Street, New York 4, N. Y., U. S. A.

Central telephone exchange equipment for installations of any size, automatic or manual.

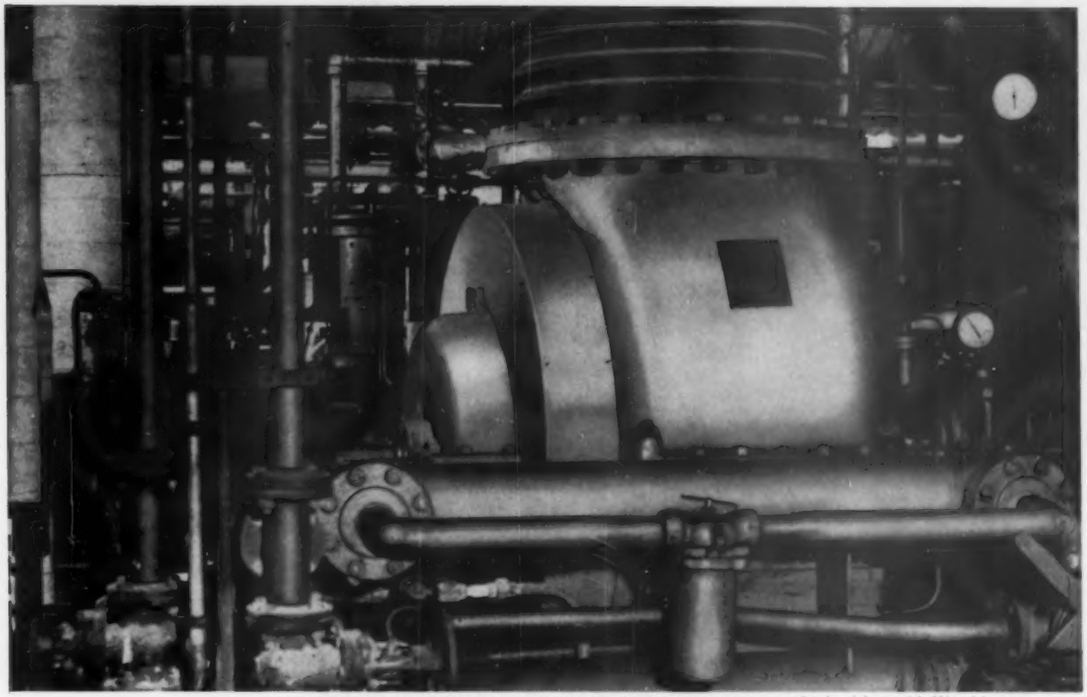


Cables, tubes, conduits, transformers—equipment, supplies for every communication and power need.

Radio aids to air navigation ... complete airport communications and lighting.

Teleprinters for automatic transmission and reception of written messages.

All equipment for television and radio broadcasting and receiving ... point-to-point communication.



LOW MAINTENANCE COSTS AND EXCELLENT STEAM ECONOMY are obtained from this Worthington high-speed turbine, one of two used to drive centrifugal blowers in this up-to-date refinery installation.

8000 rpm steam turbines operate on only 15 pounds inlet pressure

Worthington high-speed units at a Gulf Coast refinery drive centrifugal blower in cat cracker

• Steam at a pressure of 15 pounds is all it takes to power the two high-speed Worthington turbines that drive centrifugal compressors for the refining process in a cat cracker at a large Gulf Coast refinery.

Worthington steam turbines are ideally suited for blower or centrifugal compressor drives, since they are built in all sizes and speeds for the most economical unit performance. There's no need for costly speed increasing gears, either, and the turbine's adaptability to various governing arrangements allows precise control under all operating conditions.

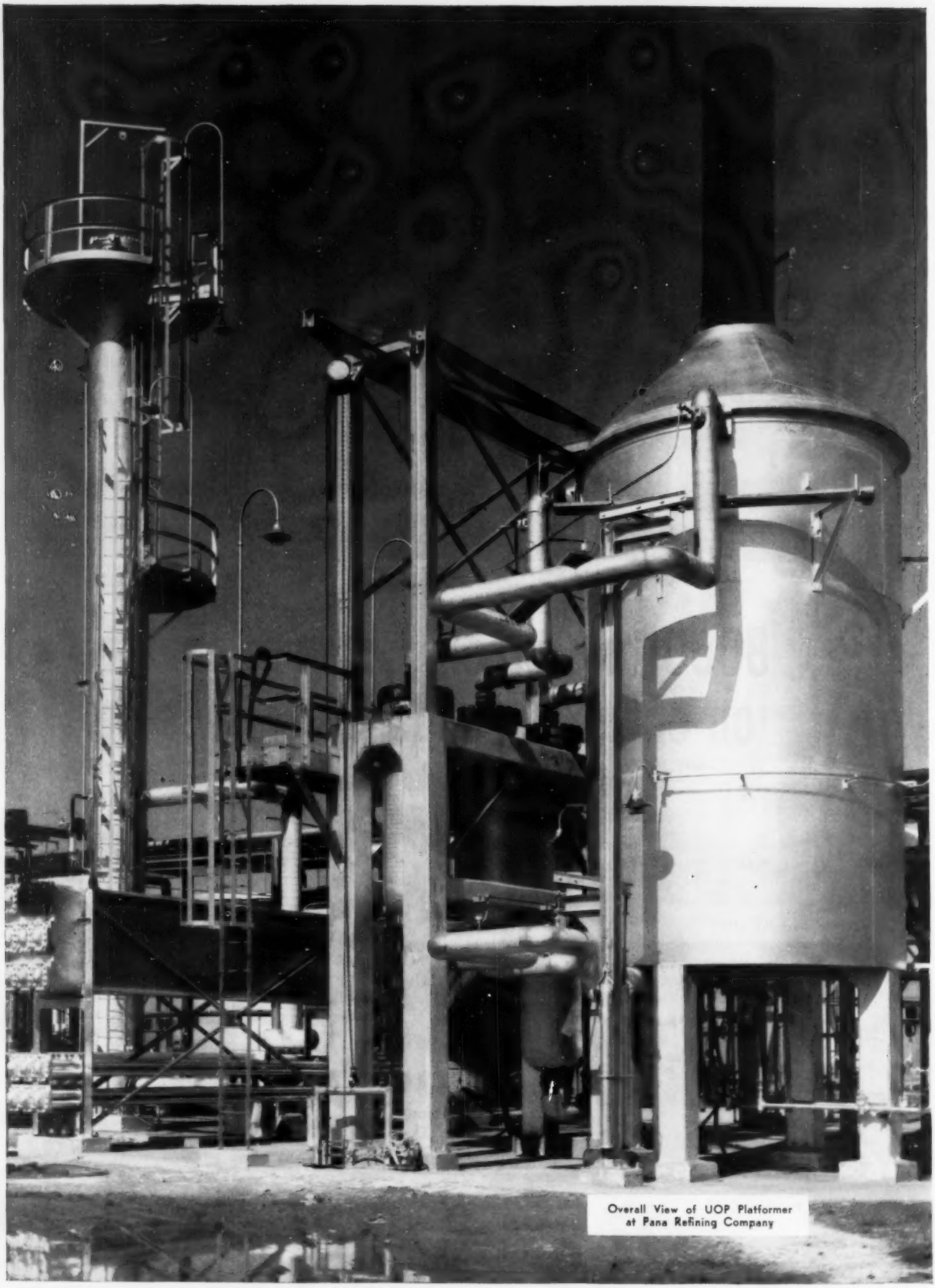
Remember, the engineering of the drive is just as important as the engineering of the compressor or blower. Worthington's long experience in compressor-drive engineering is your assurance of getting exactly the right type and size drive for your needs. Write today for Bulletin 1966 to Worthington Corporation, Export Department, Harrison, New Jersey, U.S.A.

F-4.59

WORTHINGTON

A GREAT TEAM IN STEAM

Single-Stage Turbines • Multi-Stage Turbines • Turbine-Generator Sets • Feed Water Heaters • Boiler Feed Pumps • Surface Condensers



Overall View of UOP Platformer
at Pana Refining Company

Platformer Helps Pana Achieve High Quality Goal

By R. H. Carroll, Manager
Pana Refining Company
Division of
Illinois Farm Supply Company

THE 650 B/SD UOP Platforming unit which went on stream at our refinery last October has enabled us to achieve a long-sought goal — that of making the best motor fuel known to the petroleum refining industry.

R. H. Carroll

Currently, our Platformer is consistently producing a stabilized Platformate having an octane number of 94 F-1 leaded. It is the first Platformer in commercial operation in the state of Illinois to be devoted exclusively to the production of motor fuel.

Our refinery is owned by the Illinois Farm Supply Company, and serves as one of the sources of supply of petroleum products distributed by the Illinois Farm Supply Company to its member company county service companies. These county organizations in turn distribute gasolines, greases, lubricants, burner oils, and Diesel fuels to Illinois farmers.

Products Supply Supplemented

Illinois Farm Supply purchased Pana Refining Company in the spring of 1948 in order to supplement its supply of petroleum products to its members. The refinery has been gradually modernized, with the installation of the UOP Platforming unit being the latest step. In addition to a UOP crude unit, we also have a UOP catalytic polymerization plant, and the entire refinery is under a UOP service agreement.

The Platformer is unique in that it has no feed preparation unit. The charge, which is essentially 225° to 400° F. boiling range naphtha, is removed from the UOP crude unit fractionator as a sidecut and goes directly to a charge surge drum. The end point and the over-all boiling range of the charge material is controlled by regulating the withdrawal rate of the naphtha and the end point of the lighter fraction produced from this tower.

The naphtha charge, together with the hydrogen recycle stream, enters the effluent heat exchanger before passing through the three-coil vertical heater and the three reactors.

The effluent from the reactor is split into two streams. One stream is used to supply heat to the stabilizer reboiler, then it unites with the other stream, and the combined stream passes through the heat exchanger, reactor products cooler and then to the products separator. Platformate is pressured out of the separator into the stabilizing column, where it is stabilized and sent to blending tanks.

Performs Two-Fold Duty

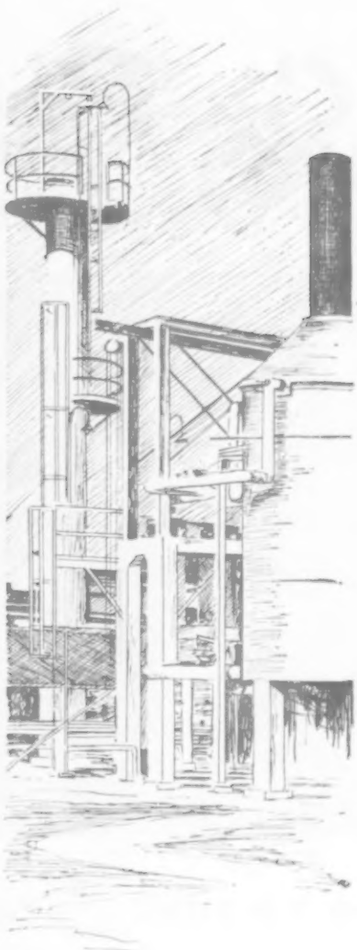
The reactor products separator performs a two-fold duty: (1) Of separating hydrogen, and (2) Of furnishing a suction tank for the hydrogen gas compressor, which takes suction on the dry side of the separator, then discharges the hydrogen back through the heaters with the naphtha charge. Excess hydrogen from the separator is used as fuel gas in the charge heater.

We were able to eliminate a feed preparation unit for the Platformer because investigation showed that the crude unit fractionator had the degree of fractionation necessary for preparation of feed stock without rerunning. The refinery at one time produced naphtha for a paint manufacturer that was essentially in the 300° to 400° F. boiling range, so we were reasonably certain that the crude fractionator could handle the type of naphtha sidecut for the Platforming unit.

By making minor revisions in the crude unit fractionator, we were able to effect considerable savings not only in the initial investment of the Platformer, but in operating costs as well.

Universal Oil Products Company engineers did the process design for the Platformer, while Procon Incorporated handled the mechanical design and drafting, purchasing and construction.

We are more than satisfied with the results obtained from our Platforming unit. It has enabled us to make the best quality balanced product at a reasonable investment in equipment, and is assuring Illinois Farm Supply Company's member companies of a constant supply of superior motor fuel.



650 B/SD
UOP PLATFORMER
PRODUCING
94 OCTANE
MOTOR FUEL
AT PANA, ILLINOIS

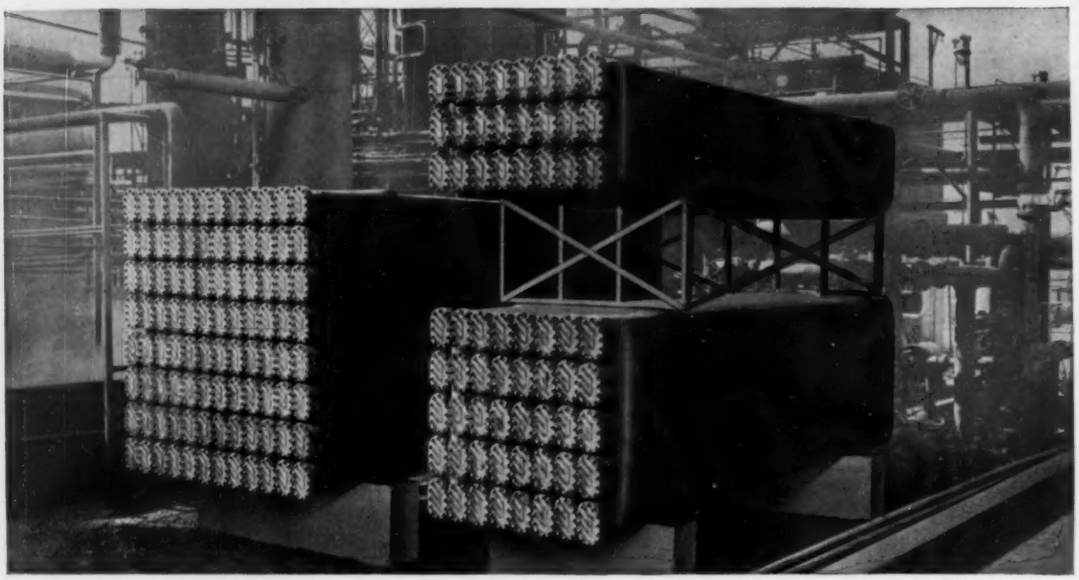
designed, engineered and licensed by

UOP UNIVERSAL OIL PRODUCTS COMPANY
30 ALGONQUIN ROAD,
DES PLAINES, ILL., U. S. A.
Laboratories: RIVERSIDE, ILLINOIS

Universal Service
Protects Your Investment

Six Reasons Why

you should specify



BROWN FINTUBE *Sectional* HEAT EXCHANGERS

FLEXIBILITY: If plant requirements change — and this is not uncommon — a "bank" of Brown Fintube heat exchanger sections can be disconnected and reassembled in different series-parallel arrangement easily and on short notice. "Bundle type" exchangers are not flexible. For them a change in duty usually involves designing — and waiting — for a whole new unit.

NO OBSOLESCENCE: Brown Fintube Sections never become obsolete. They can be used in one exchanger after another. Sections not in use serve as "standby" or parts, for other sections on stream.

REDUCED FOULING: Brown Fintube sections transfer more heat per lineal foot at lower surface temperatures. This minimizes coking. Also the longitudinal passages control the material flow eliminating eddies and reducing fouling.

EASY CLEANING: reduces maintenance costs. By manifolding just one extra parallel stream into an exchanger, the entire unit can be operated continuously — always clean — without ever coming off stream.

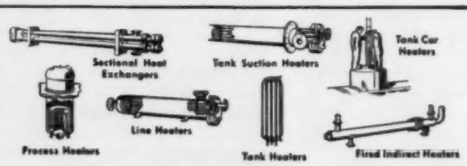
REDUCED STORES: Avoids tying up thousands of dollars in spare parts, housing and handling them.

PROMPT DELIVERY: Standardization permits economical assembly line manufacture from standardized parts — and prompt delivery.

If you heat — or cool — liquids or gases in your plant, you'll get a lot of ideas from our Bulletin No. 512. Send for a copy!

BROWN FINTUBE
HEAT TRANSFER PRODUCTS

BROWN FINTUBE CO.
Elyria, Ohio



NEW YORK • BOSTON • PHILADELPHIA • PITTSBURGH • BUFFALO • CLEVELAND • CINCINNATI • DETROIT • CHICAGO • ST. PAUL • ST. LOUIS • KANSAS CITY • MEMPHIS • BIRMINGHAM • NEW ORLEANS • SHREVEPORT • TULSA • HOUSTON • DALLAS • DENVER • LOS ANGELES • SAN FRANCISCO
BROWN FINTUBE (GREAT BRITAIN) LTD., BIRMINGHAM, ENGLAND • BROWN FINTUBE (CANADA) LTD., ST. THOMAS, ONTARIO, CANADA • FRIEDRICH UHDE, GMBH, DORTMUND, GERMANY

TAKES PLENTY OF
MANPOWER
to Bring You Flying Horsepower!

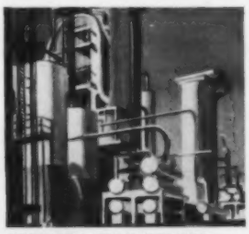
GEOLOGISTS

CONSTRUCTION WORKERS

SCIENTISTS

DRILLERS

SAILORS


REFINERY TECHNICIANS

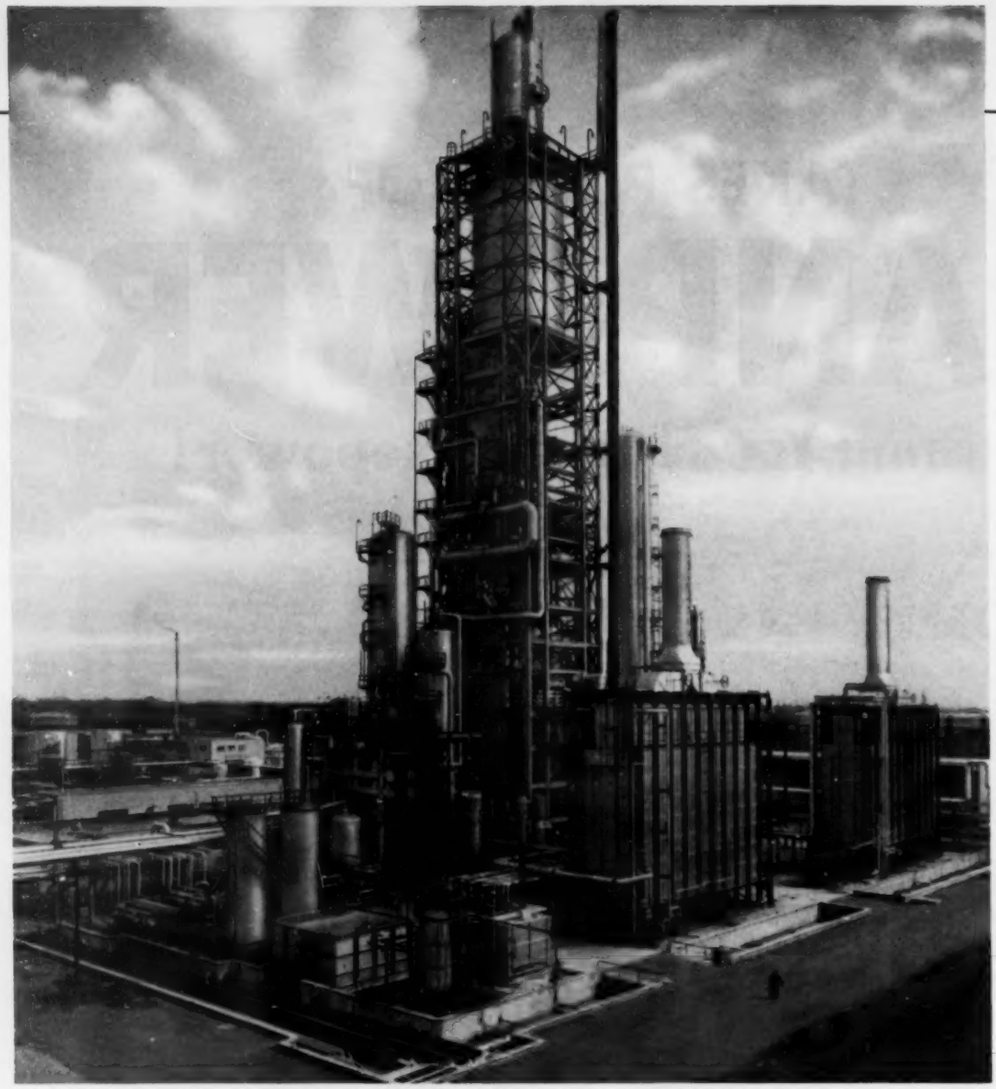
TRUCK DRIVERS

Mobilgas
SOCONY-VACUUM

SOCONY-VACUUM OIL COMPANY, INC.

and Affiliates:

MAGNOLIA PETROLEUM COMPANY • GENERAL PETROLEUM CORPORATION

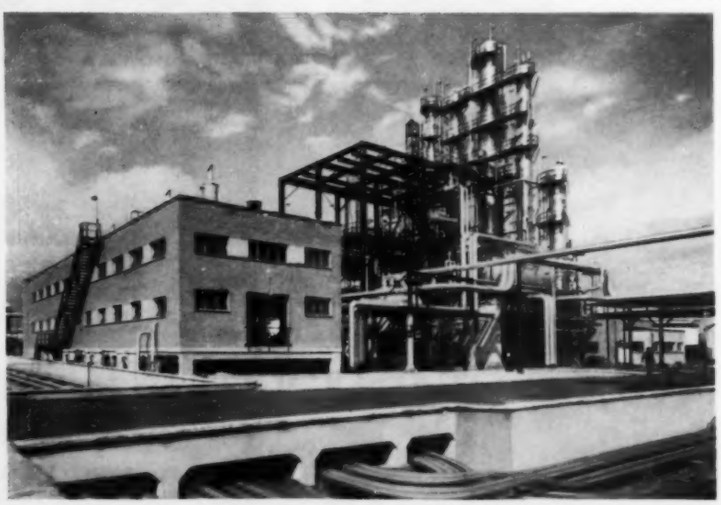


The new Condor catalytic cracking unit has a capacity of 15,000 barrels per day. The crude unit in the background has a capacity of approximately 45,000 barrels. Condor's new gas plant and compressor building are shown below.

Condor-AT RHO, NEAR MILAN

Located in the Po River Valley, and advantageously situated in relation to Italy's fine Autostrade highway system, "Condor S.p.A. L'Industria Petrolifera e Chimica," exemplifies the regeneration of Western Europe's essential industries.

The basic engineering for Condor's petroleum refinery process units was performed in the United States by Stone & Webster Engineering Corporation, with detailed engineering, procurement, and construction management by the Corporation's affiliate, E. B. Badger & Sons Limited.



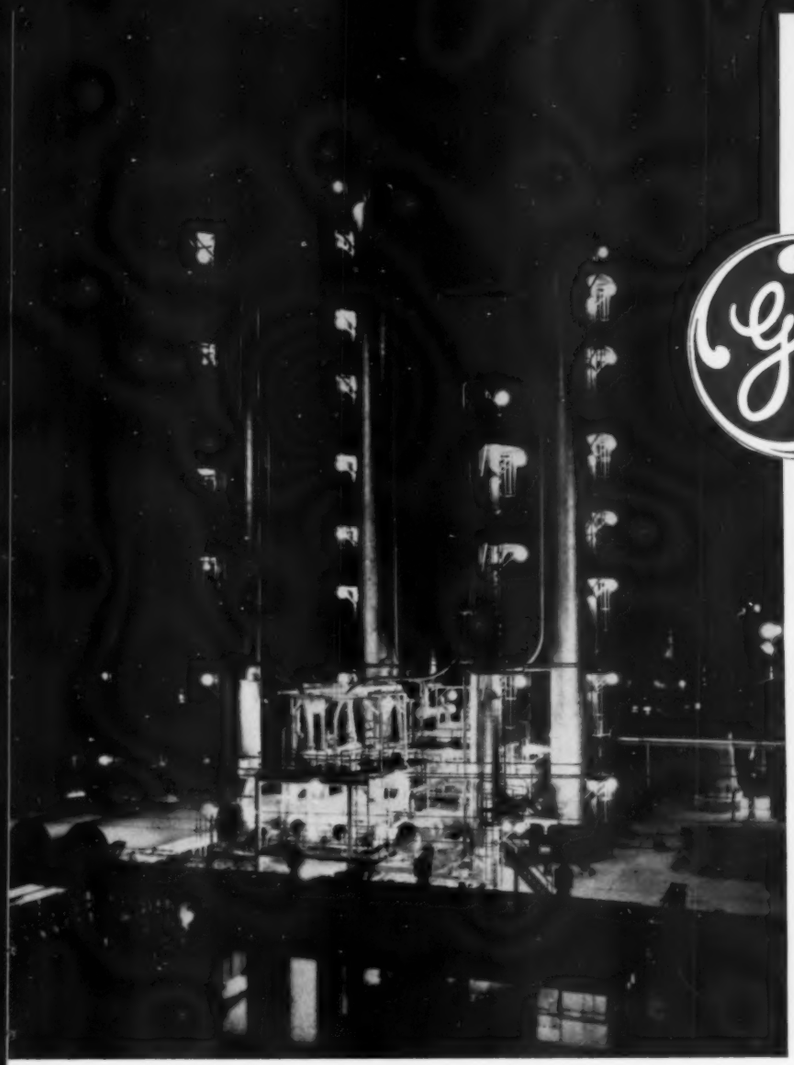
Write or call us for information as to how our experience may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

BADGER PROCESS DIVISION

AFFILIATED WITH E. B. BADGER & SONS LIMITED (LONDON)

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Toronto



ELECTRIFICATION PAYS ITS WAY

with General Electric Equipment

• Increased Safety • Reduced Maintenance and Inspection Costs •

• Continuous Operation •

IN THE REFINERY . . . Wider use of explosion-proof corrosion-resisting G-E motors and grouped controls—to simplify plant layouts, cut special construction costs; secondary selective distribution systems with G-E unit substations—to protect continuity of service at minimum cost; better protection against shutdowns with G-E selective tripping —to isolate faults on low-voltage circuits.

FOR PIPE-LINE PUMPING . . . G-E equipment will work together as an integrated system to meet your individual needs; reduces initial investment cost; cuts pumping station costs at reduced capacities, releases men for other duties, permits automatic control for simpler, more efficient operation, lowers maintenance and replacement costs.

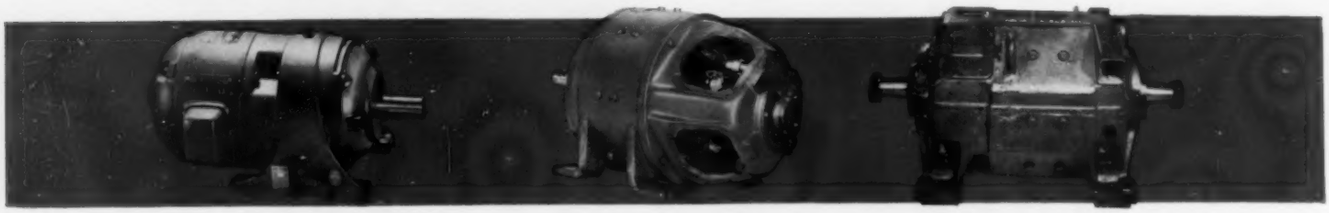
If you are planning to build, expand, or modernize, let a team of General Electric engineers help you design an electrical system for top production and flexibility. The coupon brings you full facts on G-E equipment.

GENERAL ELECTRIC

G-E MOTORS ASSURE CONTINUITY OF PRODUCTION

G.E. builds the most extensive line of motors on the market, in the widest variety of types, sizes and ratings, and for the greatest number of hazardous conditions. G-E motors and control can be located solely with reference to convenience, accessibility for maintenance, economy of space, and driving machinery. And because they are standard equipment, initial cost is lower.

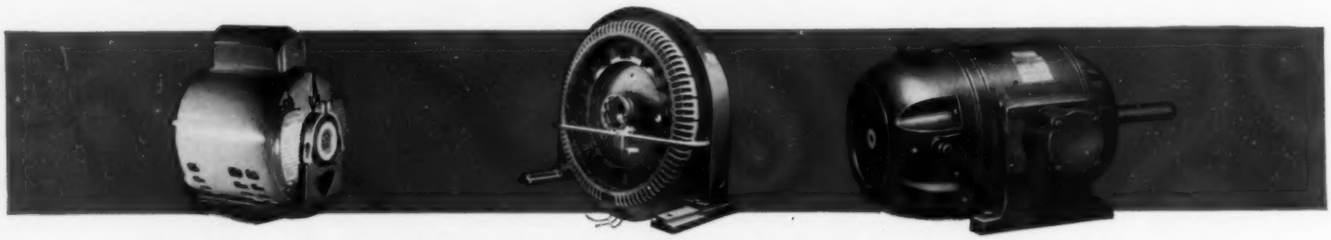
In high and low voltage control, too, you have an unusually broad range to select from. Let an experienced G-E engineer help you select the right combination for *your* special needs.



Gear Motor is compact, sturdy, for any low-speed drive. Requires only a little more space than regular motor, eliminates external speed reduction equipment.

DC Motor closely matches motor characteristics with driven-load requirements . . . for medium and heavy starting, close speed regulation, varying or adjustable speed.

Armored DC Motor operates efficiently under severe mechanical strains and heavy currents, has high mechanical strength provided by heavy, cast-steel frame and oversize shaft and bearings.

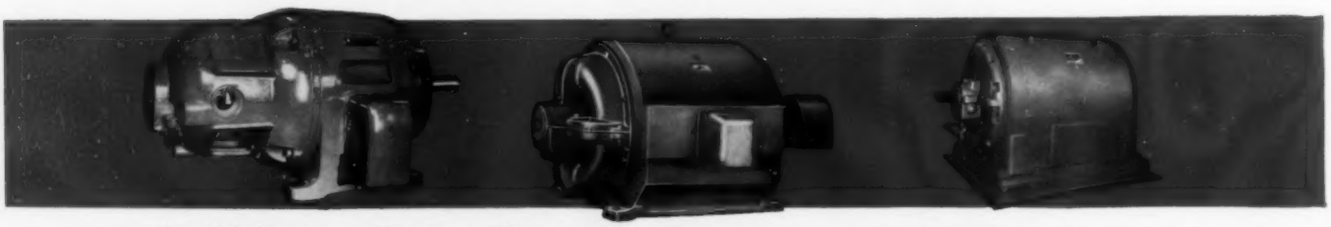


New Form G Fractional-Horsepower Motor is smaller in size, lighter in weight . . . benefits you with lower handling costs, easier mounting and all-angle operation.

Low-Speed Synchronous Motor meets pumping requirements at a reasonable cost. Desirable features include ample starting, pull-in, maximum torque, high operating efficiency, ability to improve power factor.

Tri-Clad Explosion-proof motor has sturdy, cast-iron, double-shell frame and end shields, plus reinforcing ribs for strong enclosure, non-sparking fan. In ratings up to 1000 hp at 3600 rpm.

Tri-Clad Motors Give Extra Protection Against Physical Damage, Electrical Breakdown, Operating Wear and Tear.



Wound-rotor induction motors, used in ratings below 1000 hp, permit application of adjustable-varying-speed drive to centrifugal pumps, thereby permitting more efficient operation at reduced flow.

Tri-Clad open (drip-proof) induction motor is ideal for driving pumps from behind firewall. Gives low-cost dependability. In ratings up to 3000 hp.

Enclosed Ventilated Motor, 1500 to 3000 hp or more, 3600 rpm. Available for self or externally-forced-ventilation which is particularly suitable for pipeline pumping.

G-E Limitamp motor controls are also made for semi-hazardous areas, in factory-assembled, space-saving units to meet any pipeline need.

GE MOTORS AND CONTROL MAKE CONTINUOUS SAFETY WORK TO YOUR PROFIT

G-E engineers have designed a complete line of controls for your motors. All have safety features built in. Various types of enclosures protect personnel, make apparatus immune to dust, water, explosive gases. Co-ordinated starters, circuit breakers, overload relays protect motor under all over-load and short-circuit conditions.

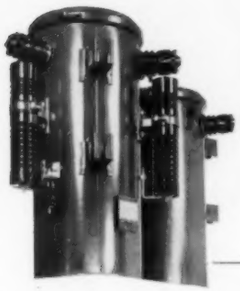
G-E Low-Voltage Motor Control centralizes auxiliary operation, is simple system for controlling, from one point, starters for all low-voltage, auxiliary-driven motors. Tamper-proof, shipped ready to install, wide range of ratings.

G-E Automatic Control gives you any degree of automatic or semi-automatic control for practically any operation.

GENERAL ELECTRIC

—U.S.A.—

One-Source Buying Means Integration & Lower Costs!

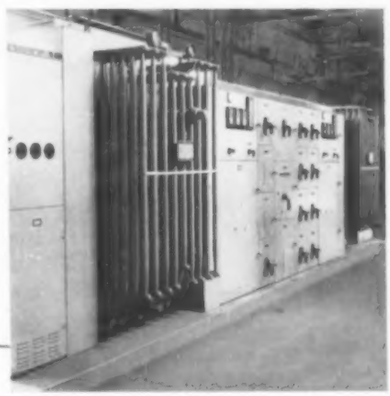


G-E SPIRAKORE TRANSFORMERS IMPROVED 2 WAYS!

New nitrile rubber gaskets at all tank openings prevent breathing . . . seal out contamination . . . resist oil, sunlight and atmosphere . . . are easily removed and used again and again.

New gapped pellet arrester: isolated from high-voltage lead . . . prevents line grounding in case of damage . . . has double discharge capacity . . . cannot corrode.

Also, G-E **Thyrite Lightning Arresters** have been improved for better station and line protection.



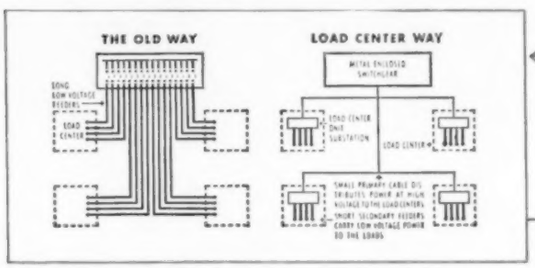
G-E Unit Substations Cut Power Costs!

Are your power needs increasing? Plan now to avoid shutdowns. Call in your G-E representative for the facts on compact, metal-enclosed G-E unit substations, indoor or outdoor.

They save you time: you select a standard unit directly from G-E specifications. Delivery is quick.

They save you money: voltage improves, copper is saved by eliminating long, secondary circuits; secondary selective system for duplicate power sources.

They give you safety: completely metal enclosed; modern, high-interrupting capacity breakers.



Dependable G-E distribution system takes power up to 13.8 kv in your plant to substations near electrical load centers where voltage is reduced to utilization levels, and fed to motors by short feeders.

G-E Switchgear Insures Strength & Safety

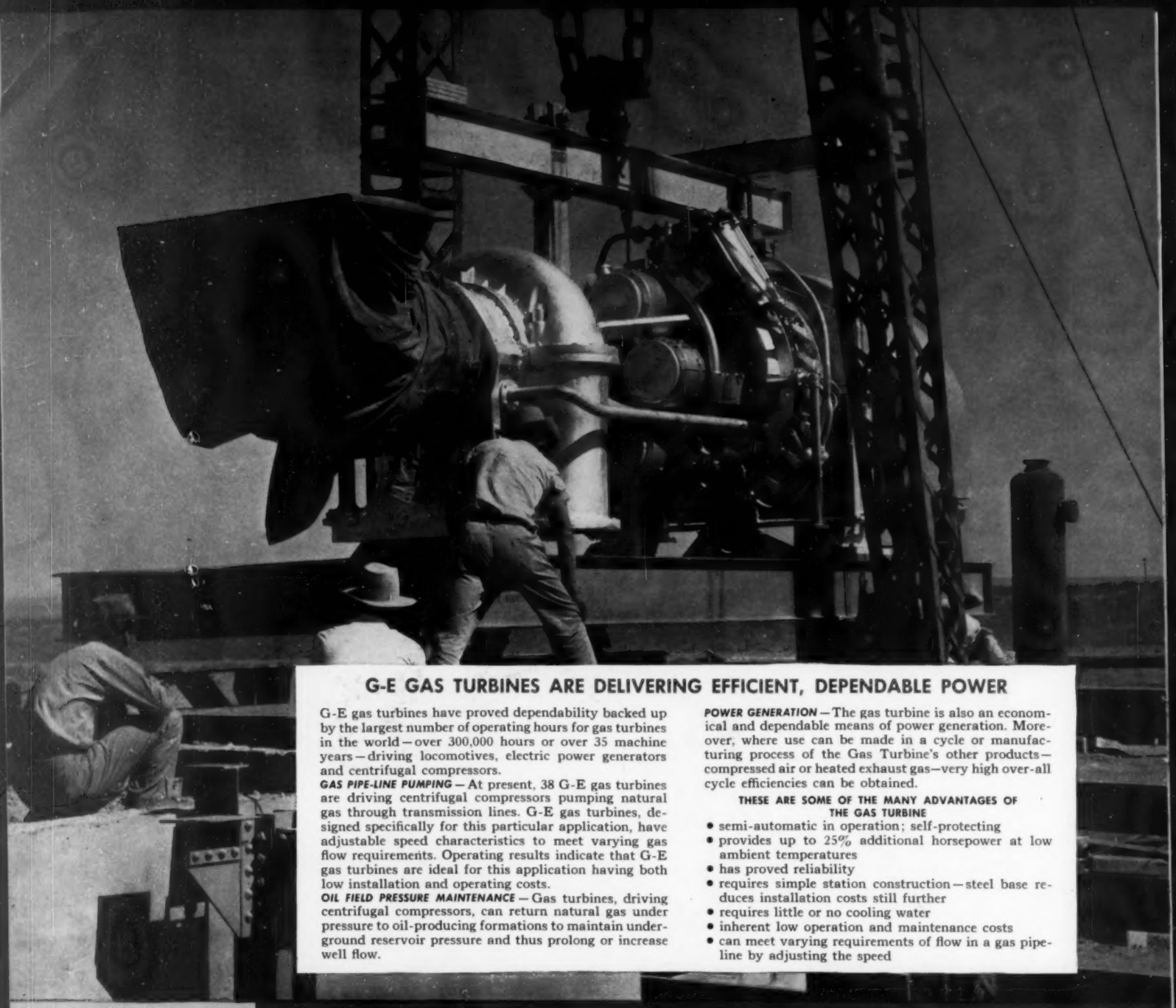
New flame-retardant material insulates circuit breaker. Totally-enclosed bus compartments. *Simple Operation & Inspection:* new magne-blast circuit breaker has maximum number of parts interchangeable among breakers of various ratings.

Faster-acting elevating mechanism, visible primary contacts in disconnect position. *Plus* . . . natural-draft ventilation, easier-to-read instruments, effortless breaker raising and lowering, simplified contact design.

G-E Capacitors Often Pay for Themselves in 2 Years or Less!

G-E capacitors increase your power factor. With a power factor clause or kva demand clause in your utility contract, increased power factor means substantial savings. Also, G-E units help circuits handle more load, raise voltage, improve motor operation.

GENERAL ELECTRIC
—U.S.A.—



G-E GAS TURBINES ARE DELIVERING EFFICIENT, DEPENDABLE POWER

G-E gas turbines have proved dependability backed up by the largest number of operating hours for gas turbines in the world—over 300,000 hours or over 35 machine years—driving locomotives, electric power generators and centrifugal compressors.

GAS PIPE-LINE PUMPING — At present, 38 G-E gas turbines are driving centrifugal compressors pumping natural gas through transmission lines. G-E gas turbines, designed specifically for this particular application, have adjustable speed characteristics to meet varying gas flow requirements. Operating results indicate that G-E gas turbines are ideal for this application having both low installation and operating costs.

OIL FIELD PRESSURE MAINTENANCE — Gas turbines, driving centrifugal compressors, can return natural gas under pressure to oil-producing formations to maintain underground reservoir pressure and thus prolong or increase well flow.

POWER GENERATION — The gas turbine is also an economical and dependable means of power generation. Moreover, where use can be made in a cycle or manufacturing process of the Gas Turbine's other products—compressed air or heated exhaust gas—very high over-all cycle efficiencies can be obtained.

THESE ARE SOME OF THE MANY ADVANTAGES OF THE GAS TURBINE

- semi-automatic in operation; self-protecting
- provides up to 25% additional horsepower at low ambient temperatures
- has proved reliability
- requires simple station construction—steel base reduces installation costs still further
- requires little or no cooling water
- inherent low operation and maintenance costs
- can meet varying requirements of flow in a gas pipeline by adjusting the speed

G-E Representatives Everywhere Are Saving Oilmen Money

Electrification can pay its way . . . and save money for you, too. For complete information, take your electrical problems to your G-E representative. Offices in principal cities of: ANGLO-EGYPTIAN SUDAN, ARGENTINA, AUSTRALIA, BOLIVIA, BRAZIL, CHILE, COLOMBIA, EGYPT, ENGLAND, FRANCE, INDIA, INDONESIA, IRAN, IRAQ, ITALY, MEXICO, NETHERLANDS, PERU, SAUDI ARABIA, TRINIDAD & TOBAGO, TURKEY, VENEZUELA.

TA-54-OE

FILL IN AND MAIL FOR FURTHER FREE INFORMATION

Name _____ Company _____

Address _____ City _____ Country _____

Please send me more facts on:

MOTORS

- ☐ Gear
- ☐ DC
- ☐ Form G Fractional Horsepower
- ☐ Wound-rotor Induction
- ☐ Tri-Clad open (drip-proof)
- ☐ Tri-Clad Explosion-proof
- ☐ Enclosed Ventilated
- ☐ Armored DC
- ☐ Low Speed Synchronous
- ☐ CONTROL
- ☐ CAPACITORS
- ☐ GAS TURBINES
- ☐ SWITCHGEAR
- ☐ TRANSFORMERS

OTHERS

- ☐ _____
- ☐ _____
- ☐ _____

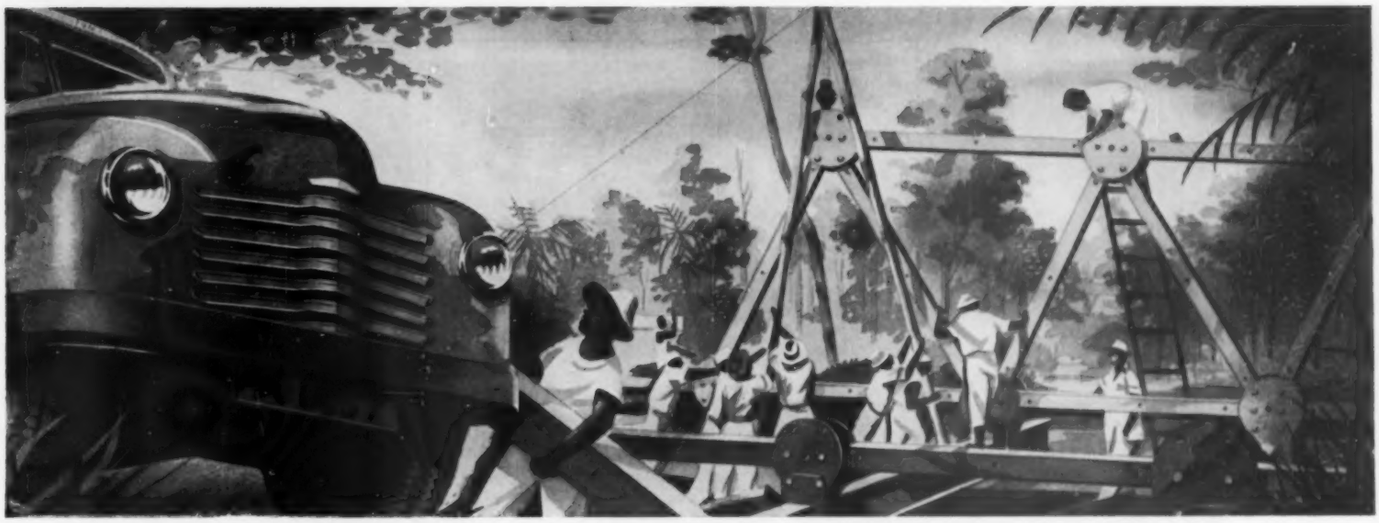
International General Electric Co., Apparatus Sales, Dept. OE, 570 Lexington Ave., New York 22, N. Y., U.S.A.

GENERAL ELECTRIC

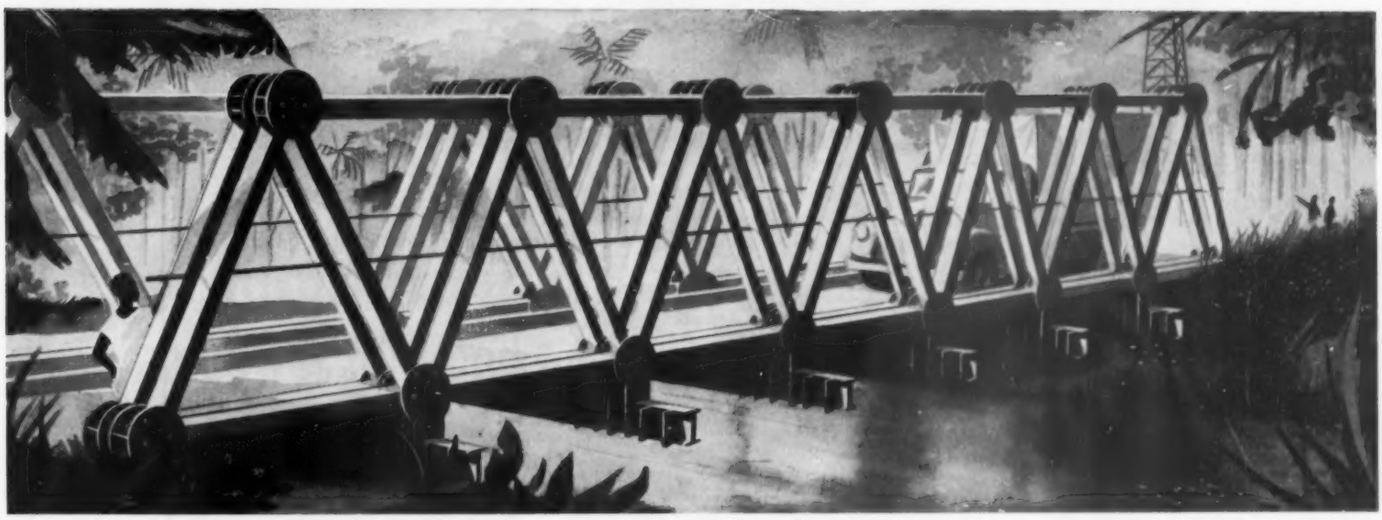
U.S.A.

PRINTED IN U.S.A.

Easily transported to...

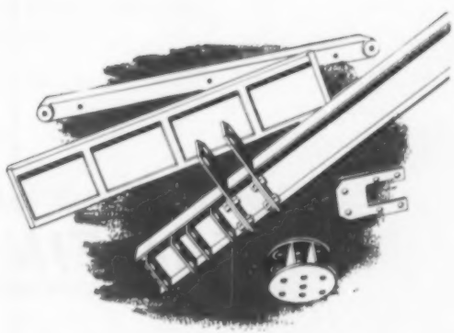


and quickly erected on...



remote up-country sites

Butterley Standard-Unit Bridges are in use all over the world where transport is difficult, skilled labour scarce or where site preparation has to be carried out under adverse conditions. From five standard units, all sizes of bridges can be built; the units can be sent by any form of transport; site erection is remarkably simple and swift with an absolute minimum of equipment.



THE BUTTERLEY STANDARD-UNIT BRIDGE

THE BUTTERLEY COMPANY LIMITED RIPLEY DERBY ENGLAND

London Office: 20 ASHLEY PLACE, VICTORIA S.W.1.

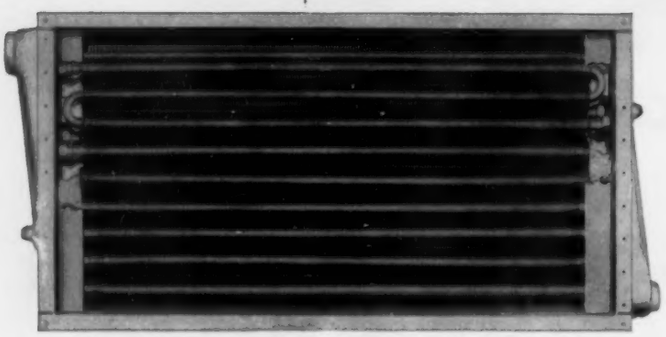
SB.28

We Make

Extended-Surface

HEAT EXCHANGERS

Exclusively



The pioneer in the field, Aerofin has concentrated on one thing, *and one thing only* — highly efficient, easily installed, easily maintained extended-surface heat exchangers. Aerofin's design, research, engineering and production experience and facilities are unequalled anywhere.

For High Efficiency, Easy Installation, Low Maintenance and Servicing Costs . . .

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

AEROFIN CORPORATION

101 Greenway Ave.
SYRACUSE, 1, N.Y.

KNOWLEDGE
a power for good

The Standard-Vacuum organization is continually expanding its educational and training programs for its 40,000 employees in the various areas where it operates.

In Indonesia, for example, 71 formal training courses as well as on-the-job instruction are giving several thousand men new skills . . . teaching them to work as a team and to produce more . . . improving their ability to shoulder responsibility . . . adding to their economic security as individuals and their economic strength as citizens.

Stanvac seeks to do its part in developing the capacities of its employees so that they become better qualified to carry on the company's operations and to participate in supervisory and administrative functions.

Greater knowledge is truly a power for good.

STANDARD-VACUUM OIL COMPANY

A name that stands for "Progress" in the East

26 BROADWAY, NEW YORK 4, N.Y.

AUSTRALIA • BURMA • CEYLON • HONG KONG • INDIA • INDO-CHINA • INDONESIA • JAPAN • KENYA • MADAGASCAR
MALAYA • NEW ZEALAND • PAKISTAN • PHILIPPINES • PORTUGUESE EAST AFRICA • RHODESIA • SINGAPORE
SOUTH PACIFIC ISLANDS • SOUTH WEST AFRICA • TANGANYIKA • THAILAND • UNION OF SOUTH AFRICA

They serve the best who wait the longest

Here's one place where cobwebs would be strictly OK—on a piping maintenance man's tools. For the less they have to work, the lower your maintenance costs.

Excessive valve maintenance is serious simply because the average plant has so many valves. So it's sound economics and good business to buy quality and low maintenance rather than "bargains" and frequent maintenance.

Naturally, the thrifty buyer always chooses quality valves, and for biggest value he insists on Crane. There's no greater assurance of dependable, low-cost performance . . . and the Crane line provides such quality in valves for every need.

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas.

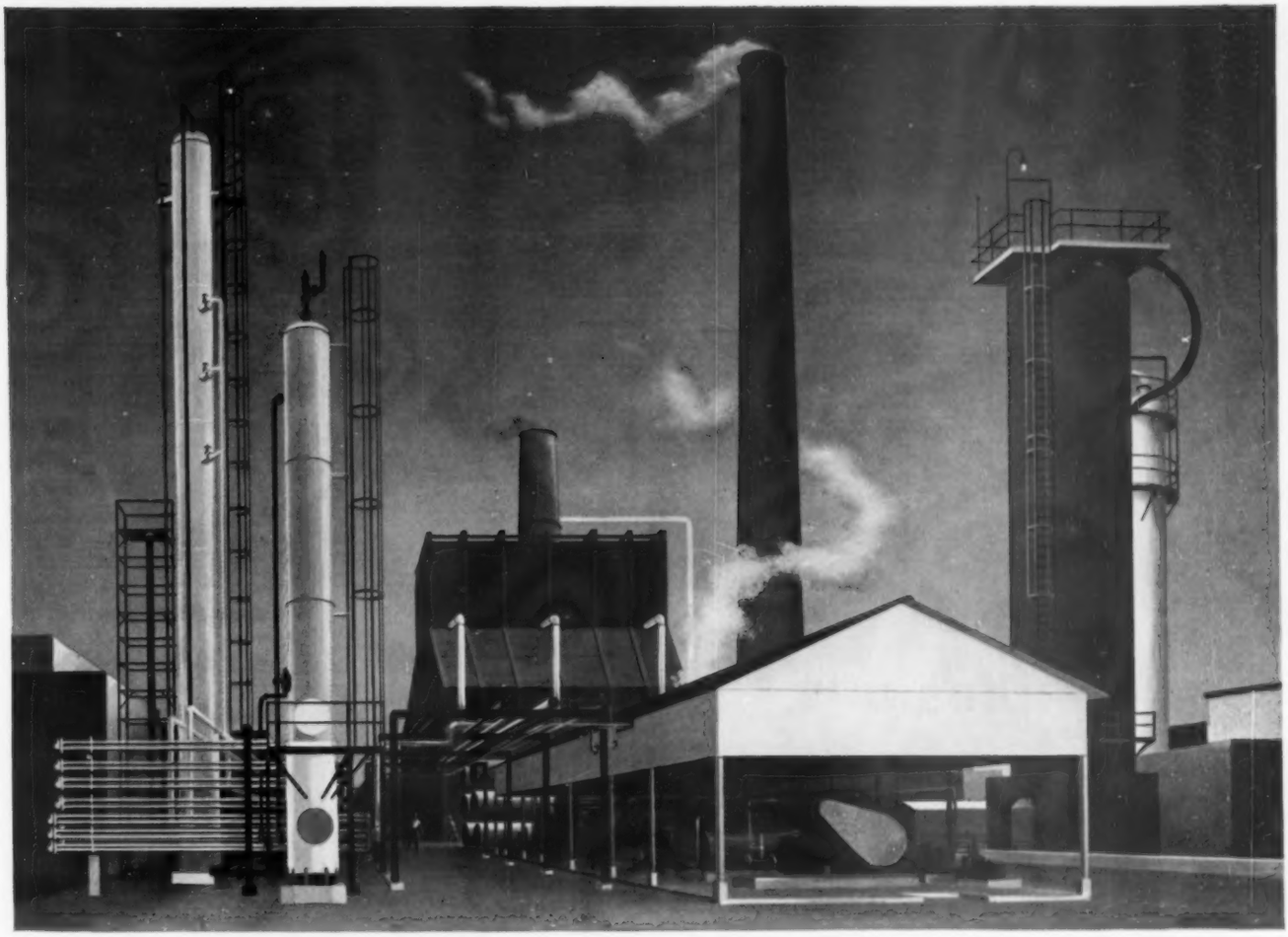
CRANE

General Offices:
Crane Co.,
836 S. Michigan Ave.,
Chicago 5, Illinois, U.S.A.

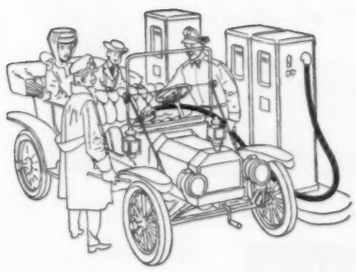
In Great Britain:
Crane Ltd.,
45-51 Lemon St.,
London E.1, England

In Canada:
Crane Limited,
1170 Beaver Hall Square,
Montreal, Quebec

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



upgrading "model T" fuels into high octane gasoline



Satisfying the thirst of millions of high compression automobile engines is becoming more and more of a headache to America's refiners.

In 1953, nearly 44 million motorists consumed almost 14 billion gallons of high octane gasoline. These premium fuels represent a mere 13 percent, or less, of the total amount of petroleum products normally processed from crude oils.

The problem: how to squeeze a higher percentage of this high-test gasoline from petroleum.

One solution lies in a process known as catalytic reforming, which applies a combination of chemical treatments to increase the yield of high octane gasoline from the tremendous surplus of less valuable, low grade fuels. For many refiners, catalytic reforming of these "model T" fuels is the difference between profit and loss.

Building plants which enable refiners to profitably recover high octane gasoline from marginal fuels is but one of many Blaw-Knox activities.

Blaw-Knox designs and constructs many types of process units to meet the refiner's everchanging product distribution and quality requirements including distillation, cracking, reforming, coking, polymerization, solvent treating and hydrogenation.

BLAW-KNOX

BLAW-KNOX COMPANY

Chemical Plants Division / Tulsa 1, Oklahoma
Pittsburgh 22, Pennsylvania / Chicago 1, Illinois

HARSHAW preformed CATALYSTS

specified by YOU...made by US!

Harshaw manufactures to specification dozens of catalysts for many different and complex manufacturing processes. The experience of more than fifteen years in helping to solve a great number of individual catalyst problems places us in a most helpful position, either in the development of the best and most economical catalyst, or in qualifying with large production capacity requirements. If you have a problem, perhaps a discussion with us will prove helpful.

SEND FOR *this 8-page booklet on Harshaw Catalysts*

PROCESS

Hydroforming · Cyclization · Oxidation
Dehydrogenation · Dehydration · Desulphurization
Alkylation · Isomerization · Hydrogenation

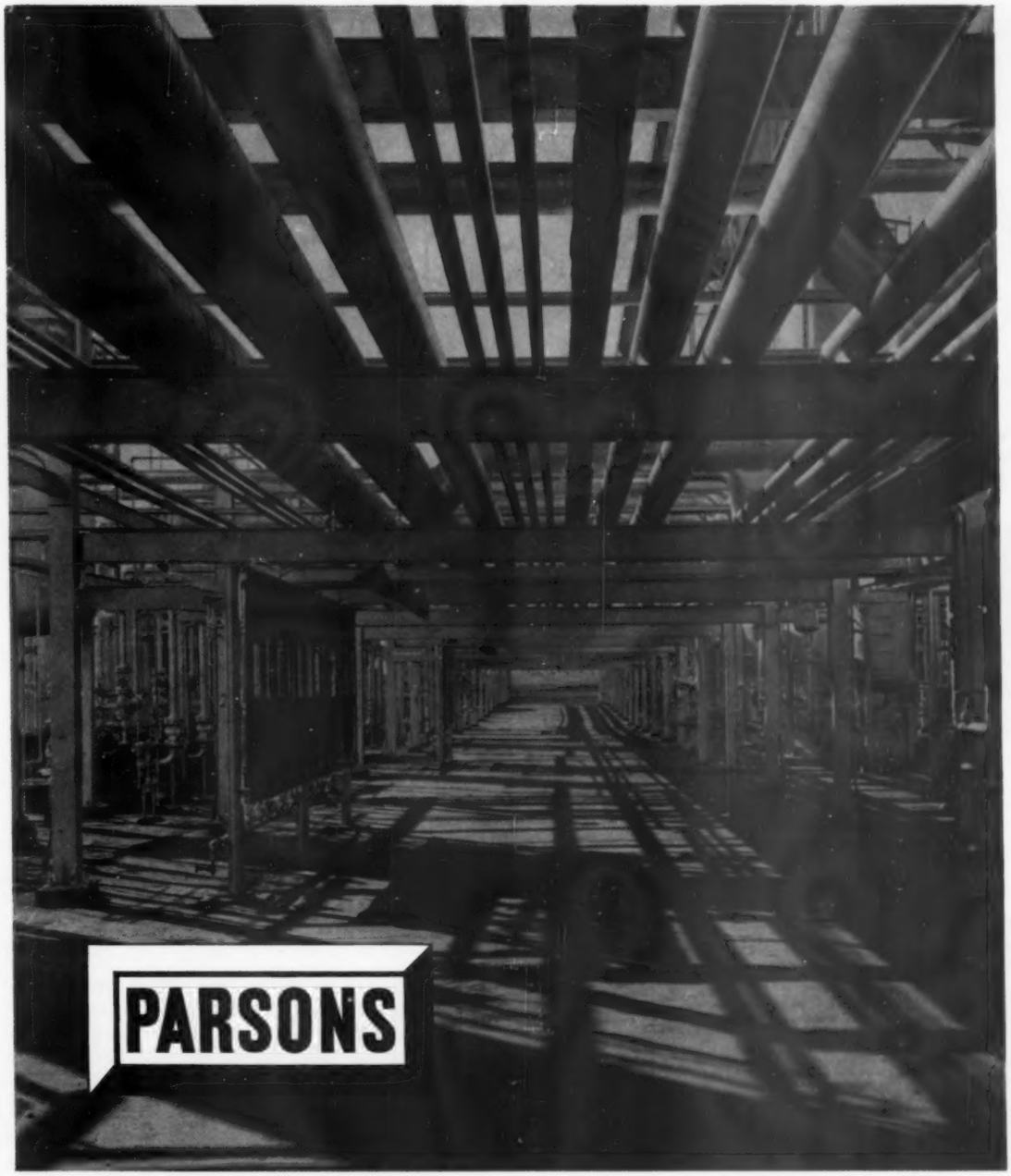
TYPICAL CATALYSTS

Aluminum Chloride Anhydrous · Boron Fluoride Addition Compounds
Boron Trifluoride · Hydrofluoric Acid Anhydrous

Alumina · Chrome Alumina · Molybdena Alumina · Tungsten Alumina
Cobalt · Copper · Magnesia · Mercury · Nickel · Vanadium

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

SALES BRANCHES: Chicago 10, Illinois, 505 North LaSalle St. • Cincinnati 13, Ohio, 6265 Wiehe Rd. • Detroit 28, Michigan, 9240 Hubbell Ave. Houston 11, Texas, 6622 Supply Row • Los Angeles 22, California, 3237 S. Garfield Ave. • New York 17, N. Y., 420 Lexington Ave. Philadelphia 48, Pennsylvania, Jackson & Swanson Sts. • Pittsburgh 22, Pennsylvania, 505 Bessemer Bldg., 6th & Duquesne Way



Serving the petroleum industry

THE RALPH M. PARSONS COMPANY

ENGINEERS · CONSTRUCTORS

617 SOUTH OLIVE STREET, LOS ANGELES 14, CALIFORNIA

NEW YORK • TULSA • WASHINGTON, D.C. • ANKARA • BAGHDAD • KARACHI

ANOTHER IMPORTANT PROJECT . . . . . Born-designed, Born-engineered Born-constructed and equipped with Born "UPFLO" Heaters . . . . .

This 15,000 barrel/day atmospheric and vacuum distillation unit enables Tide Water Associated to process any one of three crude oils with distinctly different characteristics. The heart of the plant is the three Born "UPFLO" heaters shown in the foreground.

There is a Born "UPFLO" Heater specifically designed to achieve the heating service required by your refining process. Born "UPFLO" Heaters accomplish this with highest thermal efficiencies and lowest operating costs. You'll find Born "UPFLO" Heaters in Canada, Italy, Portugal, Phillipine Islands, Colombia, and Venezuela, as well as in the U. S. A.

When planning new construction or modernization, call BORN. From this one reliable source, you get every detail of design, manufacture and construction. Born Engineering Company has been serving the petroleum and petrochemical industries more than thirty-five years. . . . .

Call, write or wire to discuss your problems.

BORN *Engineering Company*

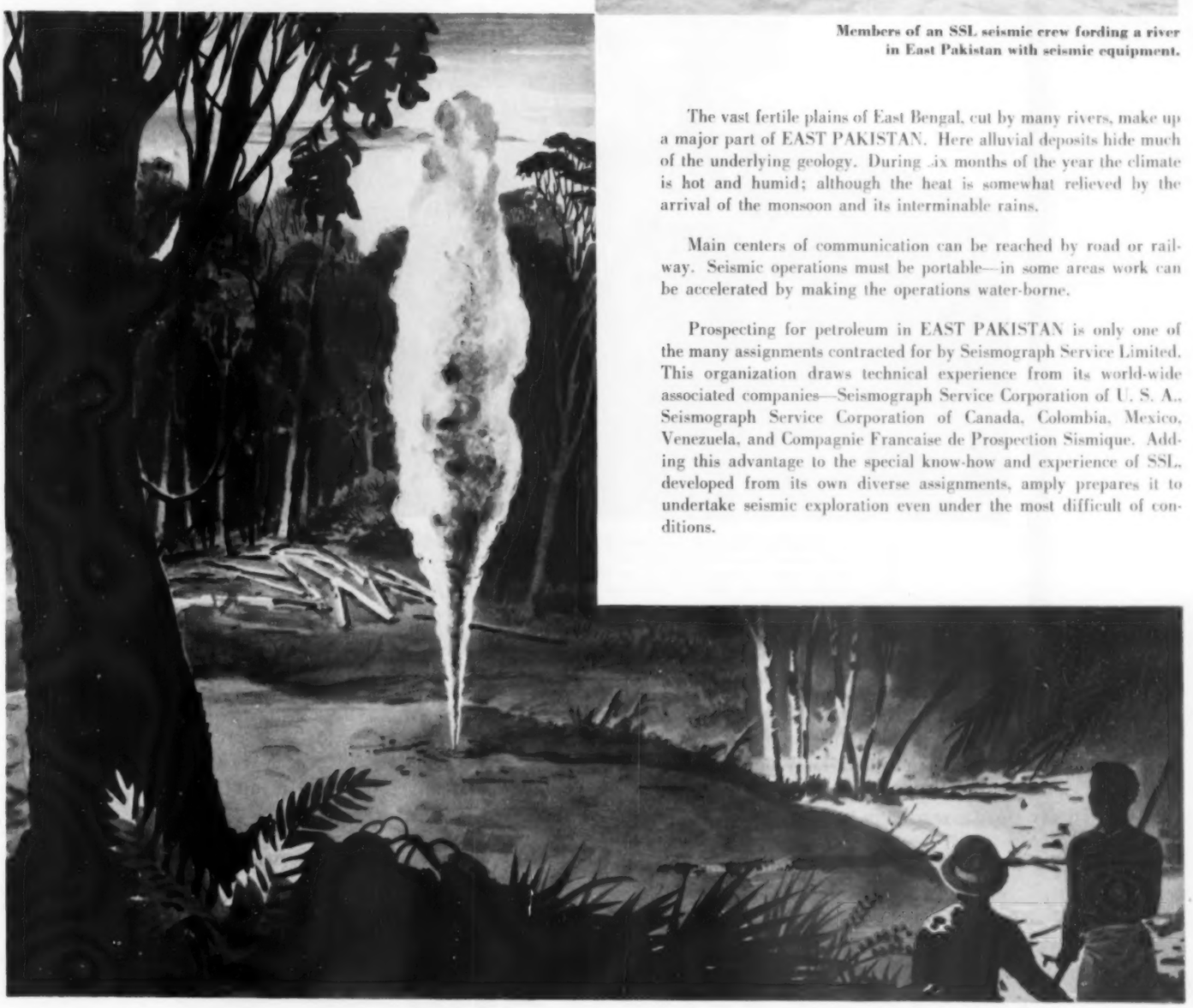
ENGINEERS and CONTRACTORS

TULSA, OKLAHOMA

BRANCH OFFICES: Denver, Colo.; Houston, Tex.; Los Angeles, Calif.; New York, N. Y.; Shreveport, La.
FOREIGN OFFICES: Paris, France: Premafrance
Canada: Canadian Brown Steel Tank Company Ltd., Brandon, Manitoba.

OIL
MUST BE DISCOVERED

Members of an SSL seismic crew fording a river in East Pakistan with seismic equipment.



The vast fertile plains of East Bengal, cut by many rivers, make up a major part of EAST PAKISTAN. Here alluvial deposits hide much of the underlying geology. During six months of the year the climate is hot and humid; although the heat is somewhat relieved by the arrival of the monsoon and its interminable rains.

Main centers of communication can be reached by road or railway. Seismic operations must be portable—in some areas work can be accelerated by making the operations water-borne.

Prospecting for petroleum in EAST PAKISTAN is only one of the many assignments contracted for by Seismograph Service Limited. This organization draws technical experience from its world-wide associated companies—Seismograph Service Corporation of U. S. A., Seismograph Service Corporation of Canada, Colombia, Mexico, Venezuela, and Compagnie Francaise de Prospection Sismique. Adding this advantage to the special know-how and experience of SSL, developed from its own diverse assignments, amply prepares it to undertake seismic exploration even under the most difficult of conditions.

Seismograph Service Limited

CABLE ADDRESS:
"SEISLIM, LONDON"

INLAND TELEGRAPHIC ADDRESS:
"SEISLIM, BROMLEY"

"HOLWOOD," KESTON, KENT, ENGLAND

SUBSIDIARY OF SEISMOGRAPH SERVICE CORPORATION, TULSA, OKLAHOMA, U. S. A.

GULF SECURITY OIL

helps insure dependable performance of gas compressor units

Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

Gulf Oil Corporation • Gulf Refining Company

1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

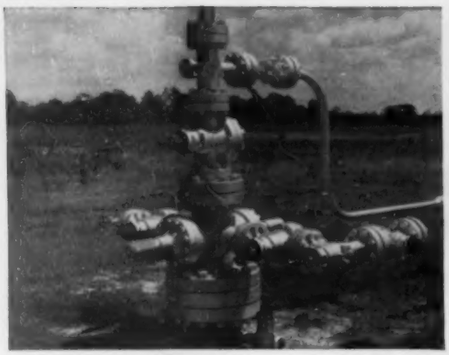
GULF INDUSTRIAL LUBRICATION

● Nalcat Division Plant No. 2 at South Gate, California, is the latest addition to Nalcat Fluid Cracking Catalyst production capacity . . . Another step toward the goal of providing instant service on catalyst requirements.

Combined production of Nalcat plants in Illinois and California assures prompt delivery, wherever you need quality catalyst. Check with Nalcat before you place your next catalyst order.

Nalcat FLUID CRACKING CATALYSTS

CATALYST DIVISION—NATIONAL ALUMINATE CORPORATION
4007 West 71st Street • Chicago 29, Illinois



CHRISTMAS TREES

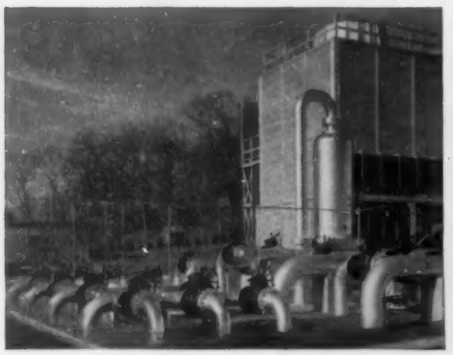
GASOLINE

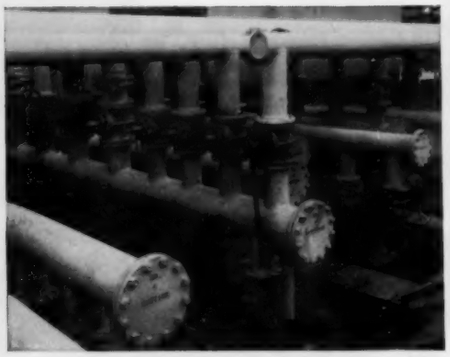
MANIFOLDS

REFINERY

GAS TRANSMISSION

PETROCHEMICAL





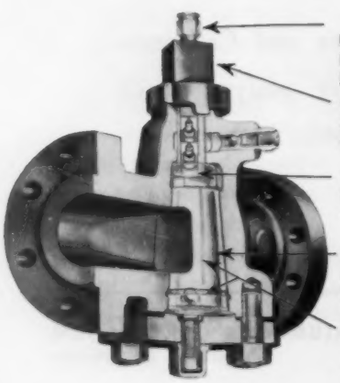
From Christmas Trees to Petrochemicals

EVERYWHERE ALONG THE LINE YOU'LL SEE

AUDCO-Nordstrom Valves

In every phase of petroleum production, refining and petrochemical operations, engineers have learned they can depend upon Audco-Nordstrom valves. You'll discover, too, that Audco-Nordstrom *pressurized lubrication* makes possible three important advantages you'll never find in ordinary valves: 1) the thin film of pressurized lubricant forms a positive seal between the valve plug and the body . . . it holds even the lightest hydrocarbons; 2) lubrication of all metal-to-metal working surfaces eliminates friction and reduces maintenance, cuts costs; 3) by turning the lubricant screw, the valve is automatically lubricated and provides jacking means if necessary.

Regardless of what your operations are, Audco-Nordstrom valves will give you better service with longer valve life at lower maintenance cost than any other valve you've ever used. There's an Audco-Nordstrom representative near you; get in touch with him or contact the offices listed below.


ROCKWELL FITTING
For Gun or Stick Lubrication
WRENCH SQUARE
One-Quarter Turn to Open or Close Valve
LUBRICANT CHAMBER
Provides Means for Jacking Plug if Necessary
TAPERED PLUG
Maximum Strength . . .
Perfect Seating . . .
Seat Never Exposed
LUBRICANT GROOVES
A Perfect Seal . . .
Cut-Offs Prevent Leakage into Line

AUDCO and Nordstrom

BRITISH

AUDLEY ENGINEERING COMPANY, LTD.
Newport, Shropshire
England

OVERSEAS AGENTS located in South Africa, Australia, India, Trinidad, British West Africa, Finland, Norway, Sweden, France, Belgium, Switzerland, Italy, Spain and Portugal

AMERICAN

ROCKWELL MANUFACTURING COMPANY
400 N. Lexington Ave.
Pittsburgh 8, Pa.

EXPORT: International Division
Rockwell Manufacturing Co.
7701 Empire State Bldg., New York 1, N.Y.

CANADIAN VALVE LICENSEE: Peacock Brothers Limited, Montreal, Que.

ROCKWELL

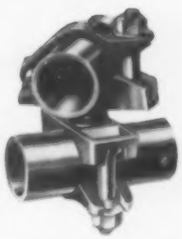
THE LONDON & MIDLAND STEEL SCAFFOLDING CO. LTD.

BURTON'S PATENT DOUBLE-GRIP SCAFFOLDING FITTINGS

BURTON'S PATENT SWIVEL COUPLER For Coupling Bracing Tubes to Strengthen Scaffold.

BURTON'S PATENT SPLIT JOINT PIN For Securing Two TUBES Firmly Together, End to End.

BURTON'S PATENT PUTLOG COUPLER For fixing Putlogs or Transoms to Horizontal Tubes.



BURTON'S PATENT DOUBLE COUPLER For Coupling Upright Tubes to Horizontal Tubes.

SOLID STEEL DROP-FORGED SCAFFOLDING FITTINGS
MANUFACTURED TO B.S.S. 1139-1951
SPECIFIED BY LEADING ENGINEERS AND CONTRACTORS

FOR SPEED & STRENGTH IN GENERAL CONSTRUCTION

WORKS: ST. LUKE'S WORKS, OLD HILL, STAFFORDSHIRE, ENGLAND
TELEPHONE: CRADLEY HEATH 6237-8 **TELEGRAMS:** DUBELGRIP, CRADLEY HEATH
LONDON OFFICE: 6, LYGON PLACE, LONDON, S.W.1.
TELEPHONE: SLOANE 7291-3 **TELEGRAMS:** DUBELGRIP, SOWEST, LONDON

POLYRAD CONTROLS CORROSION REGARDLESS OF pH

Specifically developed to control corrosion at low pH, Polyrad is a highly effective inhibitor over the entire pH range encountered in refinery operations. For example, in strong acids, such as HCL with pH under 0.1, Polyrad provides more than 98 per cent protection at temperatures as high as 180°F.

Polyrad, a filming amine inhibitor developed through Hercules research, forms a protective molecular film to shield refinery equipment from hydrogen-ion attack by organic and inorganic acids. From crude units to gas plant areas, Polyrad helps maintain throughput, increases heat transfer, reduces metal loss, and cuts down time for maintenance.

A plus feature of Polyrad is its detergent action which loosens iron sulfide and other scales so the fluid stream can remove them from process equipment.

Polyrad is readily available in Europe and the United States. We would like to work with you in evaluating it under your specific operating conditions. As a preliminary step, write Hercules for descriptive brochure.

Naval Stores Department

HERCULES POWDER COMPANY

INCORPORATED

933 Market St., Wilmington 99, Delaware, U. S. A.

POLYRAD®

FILMING AMINE INHIBITOR

Hercules Powder Company, Ltd., 140 Park Lane, London W. 1, England • N. V. Hercules Powder Company, Lange Vijverberg 12, The Hague, Holland

NAS4-2

Valves and Fittings

FOR THE OIL AND ALLIED INDUSTRIES

MUD VALVE

MUD GAUGE

PRESSURE GAUGES

FOR EVERY PURPOSE

We are specialists in the manufacture of:

Cast steel and forged steel

- Wedge Gate Valves
- Swing Check Valves
- Globe and Angle Stop Valves
- Screw Down Stop Valves
- Meter Valves
- Liquid Level Gauges
- Steam Heated Level Gauges

All types of Oil Valves and Fittings for:

CRACKING PLANT
STORAGE TANKS
REFINERIES, etc.

Write now for our BOOKLET SH/Z/B for full details of design, dimensions and specifications.

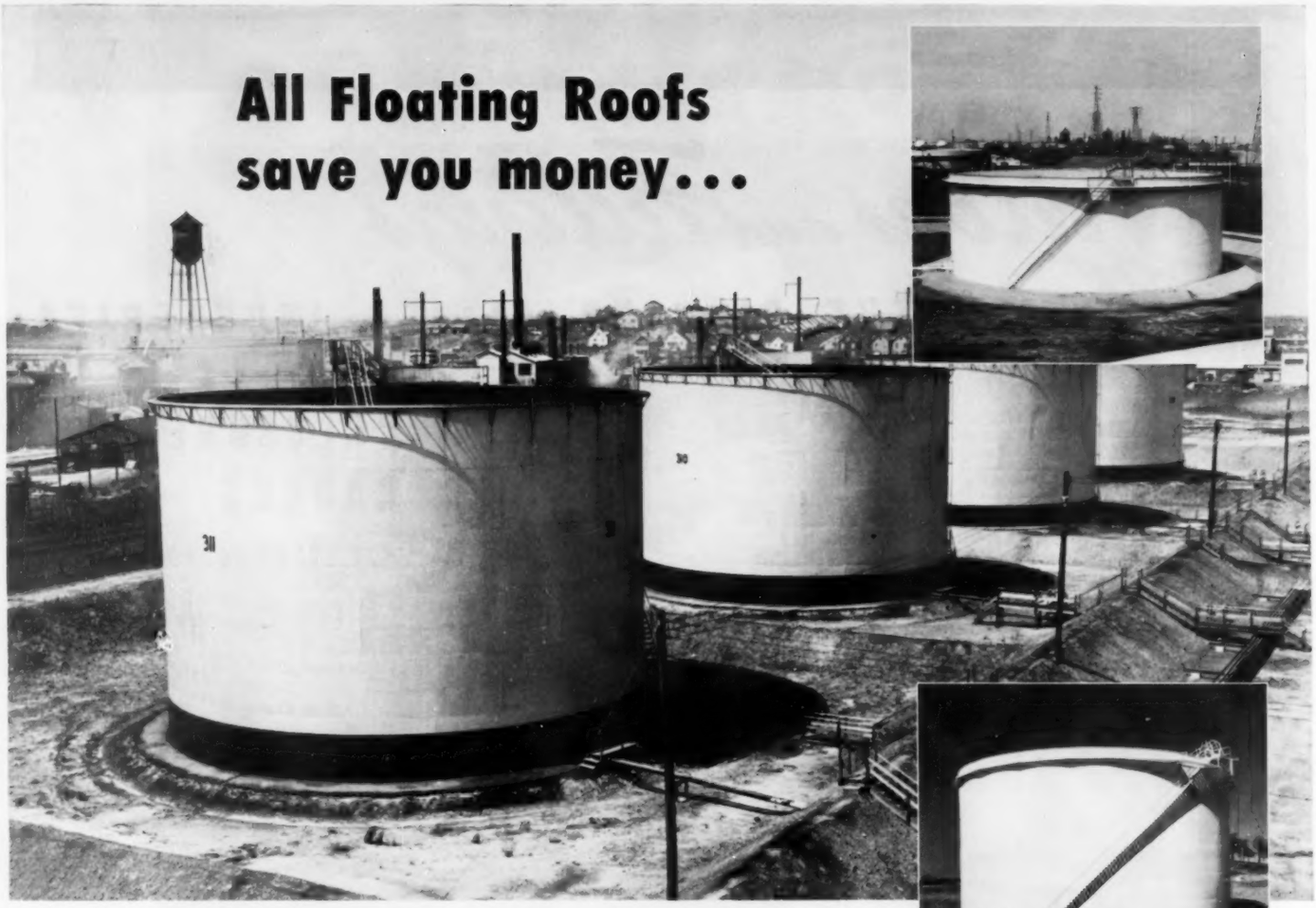
SYDNEY SMITH & SONS, (NOTTINGHAM) LTD.

BASFORD WORKS, EGYPT ROAD, NOTTINGHAM, ENGLAND

Phone: Nottingham 75031/2/3 Code: *A.B.C. 5th Edition* Grams: "Smiths, Nottingham"

LONDON OFFICE: **WHITT & CHAMBERS LTD.**

6 Lygon Place, London, S.W.1., England. Phone: SLOANE 7294/5. Grams: WHITCHAM SOWEST, London



FIND OUT HOW A

Wiggins Floating Roof

CAN SAVE MORE MONEY FOR YOU
CAN GIVE YOU BETTER OPERATION

Important savings—and all savings that help to improve profits are important—can only come about by doing a specific job better. The performance of the Wiggins Floating Roof has been analyzed and compared with all other types throughout the world in every range of temperature and climate.

It is a proven fact that the Wiggins Triple Seal is a major factor enabling Wiggins Roofs to save more of the volatile vapors—meaning profit—than can any other type. Thus a Wiggins installation "pays out" more quickly.

That's not all; the Wiggins designs take into account those matters of conservation, safety and maintenance so thoroughly that when you have a Wiggins Floating Roof you have one that sets a new, high standard of performance—and in investment, too.

Maybe not today, or tomorrow . . . but *soon* you may decide to modernize by the installation of the finest money-saving equipment available.

However, *now* is the time to write for important technical data comparing Wiggins Floating Roof, feature for feature, result for result, with all other roofs. We can prove that Wiggins Floating Roofs do the best job, the most profitable job, under all conditions.

EXPORT DIVISION
GENERAL AMERICAN
TRADE MARK

LICENSEES

Etablts. Delattre & Frouard Reunis
39, Rue de la Bienfaisance
Paris, France

Societa Italiana Ernesto Breda
Via Bordoni 9—Casella Postale 3590
Milan, Italy

A. E. Goodwin Ltd.
47 Forsyth Street, Glebe
Sydney, Australia

Sanson Vasconcellos
Comercio e Industria de Ferro S.A.
Rua Frei Caneca, 47/49
Rio de Janeiro, Brazil

Tsukishima Kikai Company Ltd.
9,5-chome, Tsukishima-dori, Chuo-Ku
Tokyo, Japan

Toronto Iron Works Ltd.
629 Eastern Avenue
Toronto, Ont., Canada

GENERAL AMERICAN TRANSPORTATION CORPORATION

Export Division: 380 Madison Avenue, New York 17, New York

PETROLEUM CHEMICALS DIVISION

NEWS

July ★ One of a Series of Interest to the Petroleum Industry ★ 1954

NEW WEST COAST TERMINAL FACILITIES

Beginning in August of this year, refiners in the northern Washington area will be able to receive tetraethyl lead shipments direct from the new Du Pont terminal which is being constructed near Ferndale.

The terminal will supply TEL either in railroad tank cars or tank trucks, both of which can quickly deliver the compound throughout this rapidly expanding refinery area.

New Movie to Help Your Dealers Handle Gasoline Complaints

The chances are that your *products* get the blame whenever a customer's car begins to act up. And your dealers are on the firing line whenever a customer complains.

The gasoline, however, is not always at fault when an engine knocks or fails to function properly. The trouble is often caused by such natural factors as low humidity or high temperature . . . by mechanical factors such as too lean a carburetor setting, an overadvanced spark, or a faulty water pump, thermostat, fan belt or other engine troubles that cause excessively high engine temperature. Poor driving habits also increase the tendency for knock to occur.

But your big problem is teaching dealers to explain these common causes of knock to customers in a salesmanlike way. To help you solve this problem, the Du Pont Petroleum Chemicals Division is now making a movie which explains simply and graphically the common cause of knock.

The Petroleum Laboratory's completely equipped chassis dynamometer is being used in the movie to show how various factors cause knock by their influence on combustion reactions.

The movie script and demonstrations are easy to understand and remember. It will be, therefore, suitable for showings to customer groups as well as for use in your dealer training program.

Production of the movie is not expected to be completed until later this year. Its availability will be announced at that time.

Spindletop Roars in Again for Multi-million TV Audience

Du Pont makes movie about this famous oil well for "Cavalcade of America" TV program

When she blew 'er top, the world went into high gear. That is how a schoolboy might describe the momentous occasion of January 10, 1901, when Spindletop gushed up and spattered her wooden derrick over the Texas landscape.

SPINDLETOP COMES IN with a roar of gushing oil that sends her derrick flying. It is a moment of triumph for Anthony Lucas and his wife Caroline, played in the film by William Bishop and Nancy Hale.

Photographs courtesy of General Petroleum Corporation, who rendered valuable assistance in filming "Spindletop."

The blowout of this fabulous well that tapped the tremendous petroleum resources of the Texas Gulf region is one of the epic moments in the history of our oil industry. Early this year, the scene was dramatically re-created and filmed for television so that millions of Americans can know the story as it happened.

Authentic Tools

Although filmed in California, the movie is authentic in mechanical and historical detail. To properly set the stage, old-time drilling tools were scouted out of rusting junk heaps on

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *Spindletop*

leases all the way from Maricopa to Coalinga. Mariana No. 77 at the south end of Belridge field was chosen as the blowout site. In the final scene, the old wooden derrick that had stood for something like 30 years over Mariana No. 77 is completely and realistically destroyed by the terrific pressure of the blowout.

IN ORDER TO REACH the final depths of Spindletop, Captain Lucas designed this special steam valve equipment.

Network Telecast

The "Spindletop" film was specially made by Du Pont for showing on the "Cavalcade of America" television program on May 11. This program is seen by an average weekly audience of 12.5 million viewers. The theme of the movie is one that tells a powerfully dramatic and convincing story of the rugged pioneering spirit typical of the American Oil Industry. As such, this first showing had considerable public relations value for the whole industry.

Captain Lucas' Struggle

Like all "Cavalcade" programs, the "Spindletop" story revolves around an individual who has carved a place in

OIL DRILLING equipment, typical of the times, is used in the staging of the movie.

our country's history through outstanding accomplishment . . . in this case, Captain Anthony Lucas.

The setbacks and heartbreaks of wildcatting—as well as the drama, the excitement, and the thrill of success—are accurately portrayed in the film . . . as seen through the struggle of Captain Lucas to push through to success a venture he believed in.

Available to you

Prints of the "Spindletop" film are now available to your company for use in your own public relations program. Address your request to any of the Du Pont Petroleum Chemicals Division regional offices listed below.

SALES PROMOTION MANAGER

R. CARTER W. JONES was recently named Sales Promotion Manager of the Du Pont Petroleum Chemicals Division.

A graduate of the University of Virginia with a B. S. degree in chemistry, Mr. Jones joined the Du Pont Company in 1936 as a chemist at the Jackson Laboratory. In 1939 he was made manager of the Du Pont Tetraethyl Lead Laboratory.

He then became a sales correspondent for chemical intermediates. And from 1941 to 1946 he was engaged in research work at the Du Pont Petroleum Laboratory. After this, he was assigned to the Technical Section of the Petroleum Chemicals Division. Mr. Jones transferred to the Division's Sales Promotion group in 1950.

R. CARTER W. JONES

Regional Laboratories Offer Aid to Refiners on Antioxidant Sweetening Problems

TOM BINFORD, Supervisor of the Du Pont Petroleum Chemicals Division West Coast Regional Laboratory, calibrates the air regulator during a plant antioxidant sweetening trial at a West Coast refinery.

To be practical, results of laboratory antioxidant sweetening trials — even when run with your own refinery stocks — have to be adapted to plant practice.

During the past years, our five Regional Laboratories have gained considerable experience in this work. As a result, we can offer you valuable assistance in setting up and operating an antioxidant sweetening process.

A Du Pont representative will be glad to consult with your own personnel right at the refinery on equipment selection and installation. And during a plant antioxidant sweetening trial, he will help in the testing for antioxidant and mercaptan content, on sampling of refinery stocks, and in checking antioxidant and air addition equipment.

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • *Wilmington 98, Delaware*

Regional Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas . Phone COlumbus 5-3620
CHICAGO, ILL.—8 So. Michigan Blvd. . . . . Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue . . . . . Phone Tulsa 5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. . . . . Phone PReston 2857
LOS ANGELES, CALIF.—612 So. Flower St. . . . . Phone MAdison 5-1691
IN CANADA: Du Pont Company of Canada Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

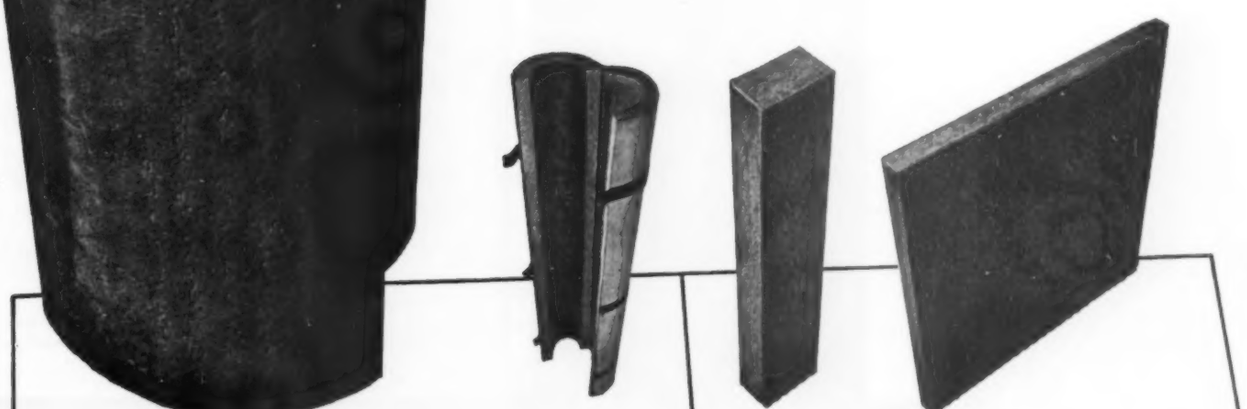
A-7551

Printed in U. S. A.

all asbestos

–and a good deal more

CAPOSITE insulation is not just all-asbestos. It is *all-amosite;* amosite being the uniquely long-fibred asbestos—from the Cape Asbestos Co. Ltd's own mines—which makes possible CAPOSITE'S particularly open, cellular texture. This texture gives it a level of thermal insulation which saves over 98 per cent. of uncovered hot surface losses, plus a resistance to the severest conditions of steam heat which enables it to maintain this efficiency almost indefinitely. CAPOSITE pre-formed pipe-sections and slabs are extremely strong, yet light and easy to fit; non-corrosive; and exceptionally economical. Write for full details.

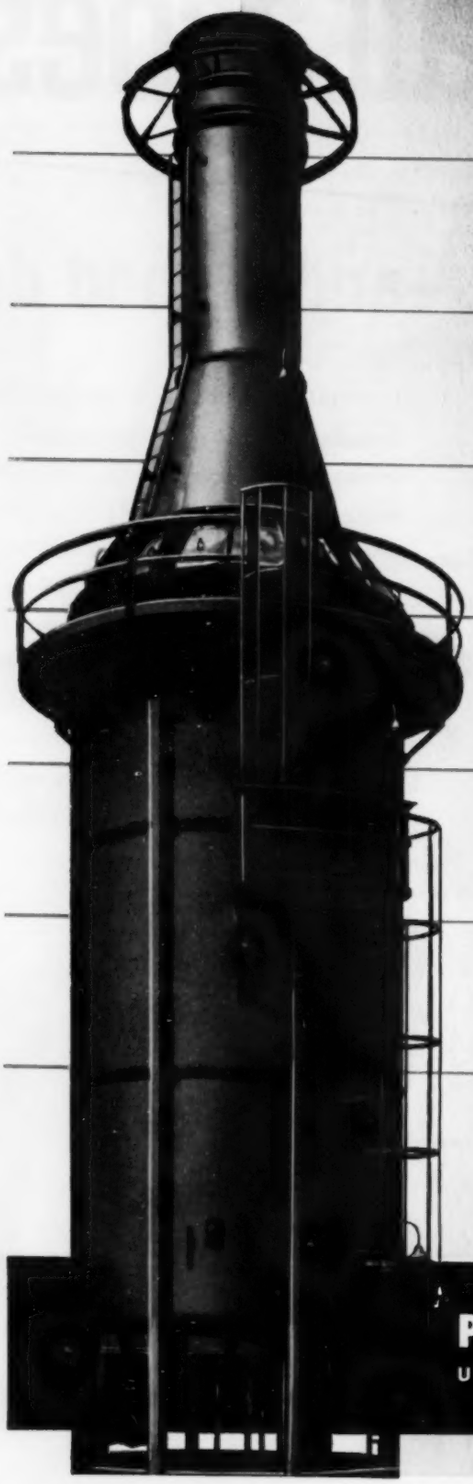


CAPOSITE

100% PURE ASBESTOS INSULATION

The Cape Asbestos Co. Ltd., 114-116 Park Street, London, W.1. Tel: GROsvenor 6022

TA 5065



671 Isoflow Furnaces — specified by 65 contractors

612 Isoflow Furnaces — installed by 120 Oil Refining Companies

296 Isoflow Furnaces — installed by 62 Chemical Manufacturers

177 Isoflow Furnaces — installed by 52 Field Processing Gasoline Companies

88 Isoflow Furnaces — installed by 25 Pipe Line Companies

33 Isoflow Furnaces — installed by 14 air heating and steam generating Utilities

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

There's no better testimony to customer satisfaction than

REPEAT ORDERS

Repeat orders for Petrochem-Isoflow Furnaces prove their unique technological features are best by any comparison:

DESIGN
uniform heat distribution • minimum ground space
short length of liquid travel
excess draft for high overload
proper proportions • simplicity

CONSTRUCTION
explosion resistant • maximum prefabrication
plenum chambers for hazardous areas

PERFORMANCE
low maintenance • zero air leakage
maximum fuel efficiency • low pressure drop

PETROCHEM-ISOFLOW FURNACES ARE BEST BY ANY COMPARISON

More than 1200 are in operation throughout the world in the petroleum, chemical and allied industries... for all processes and for any duty, pressure, temperature and efficiency... and all Petrochem-Isoflow Furnaces are pre-eminently satisfactory.

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42ND STREET, NEW YORK 17, N. Y.

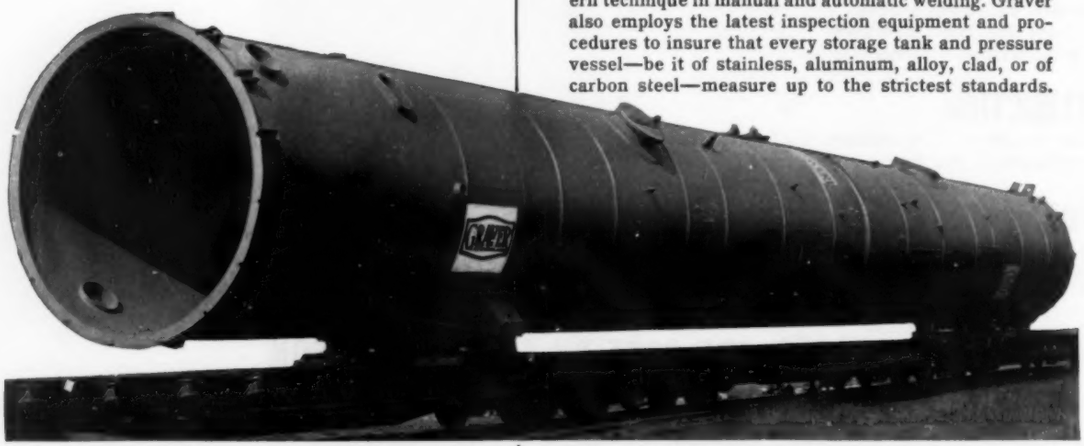
Representatives: Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh • Faville-Levally, Chicago • Lester Oberholtz, California • Gordon D. Hardin, Louisville, Kentucky • Turbex Equipment Co., Narberth, Pa.

Foreign Licensees: England – BIRWELCO, LTD., Birmingham 6 • France – HEURTEY & CIE, Paris • Germany – DR. C. OTTO & COMP., Bochum

what GRAVER craftsmanship means:

Applied Research! These Graver engineers are running distortion tests in the welding laboratory. Our research in welding techniques has resulted in numerous advances in the industry, including another Graver "first," the automatic vertical-seam field welder.

Expert Welding! This skilled Graver craftsman is busy welding special alloy strips to the inside of a large saturation absorber. Graver utilizes every modern technique in manual and automatic welding. Graver also employs the latest inspection equipment and procedures to insure that every storage tank and pressure vessel—be it of stainless, aluminum, alloy, clad, or of carbon steel—measure up to the strictest standards.



The Finished Product! This huge 106-ton fractionator tower measures 11′ 6″ I.D. by 120′ 2″ in height. It evidences the painstaking research, experienced ability, and thorough inspections that are part of every Graver product.

GRAVER ... *Specialists in the fabrication of towers, tanks, pressure vessels*

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

NEW YORK • CHICAGO • PHILADELPHIA • ATLANTA • DETROIT • CLEVELAND • PITTSBURGH • HOUSTON • CATASAUQUA, PA. • SAND SPRINGS, OKLA. • CASPER, WYO. • ODESSA, TEXAS • LOS ANGELES • EDGE MOOR, DEL. • TULSA FONTANA, CALIF. • SAN FRANCISCO.

Now, for a new high in catalyst utilization!

three new grades of Synthetic Fluid Cracking Catalyst

covering all fluid cracking unit requirements—

for fluid units with

low linear gas velocities
adequate dust disengaging space
excellent cyclone and Cottrell efficiency
low bed density needs

Aerocat® 50/60
(Light)

low apparent bulk density
low average particle size
33% below 30 microns
only 8% above 80 microns

for fluid units with

moderate to high linear gas velocities
adequate catalyst recovery

Aerocat 60/70
(Intermediate)

well-balanced particle size distribution
in 30 to 80 micron range
7% below 30 microns
24% above 80 microns

for fluid units with

high linear gas velocities
moderate disengaging space
limited recovery equipment

Aerocat 75/85
(Narrow)

particle size distribution concentrated
in 30 to 80 micron range
gives best fluidization possible with
narrow cut catalyst
75-85% in 30 to 80 micron range
5-10% below 30 microns
15% above 80 microns

Better catalyst usage, higher fluid cracking efficiency

Based on existing fluid unit needs

To provide refiners a better selection of fluid cracking catalyst grades, we first surveyed the industry to pin-point the type of fluid units operating, and their cracking catalyst requirements.

This study revealed certain basic types of operation. Accordingly, the three new grades of AEROCAT MS catalyst were designed to give optimum catalyst usage under any particular set of conditions.

Offers you better selection for higher cracking efficiency

These new grades of AEROCAT cover the entire range of fluid catalyst requirements. The new grades, representing the widest range available anywhere, will help you select the catalyst best suited to *your* fluid catalytic cracking operation.

You will certainly want to consider these grades in connection with your unit requirements. A data sheet will be mailed on request, or you may call on one of our Technical Representatives.

Aerocat® MS Synthetic Fluid Cracking Catalyst

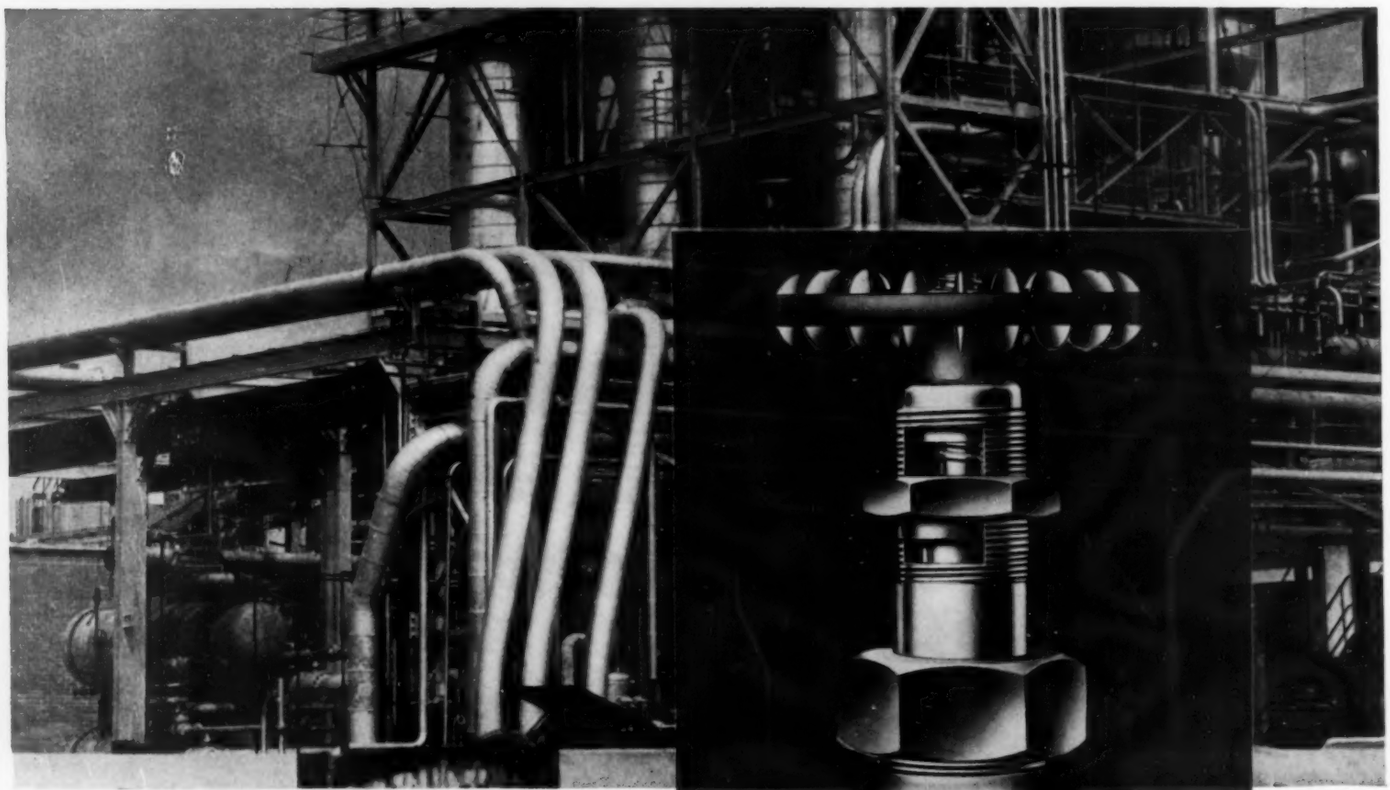
AMERICAN Cyanamid COMPANY

REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

Regularly supplied to the PETROLEUM INDUSTRY

NEWMAN-HENDER *valves*



A SHELL PHOTO

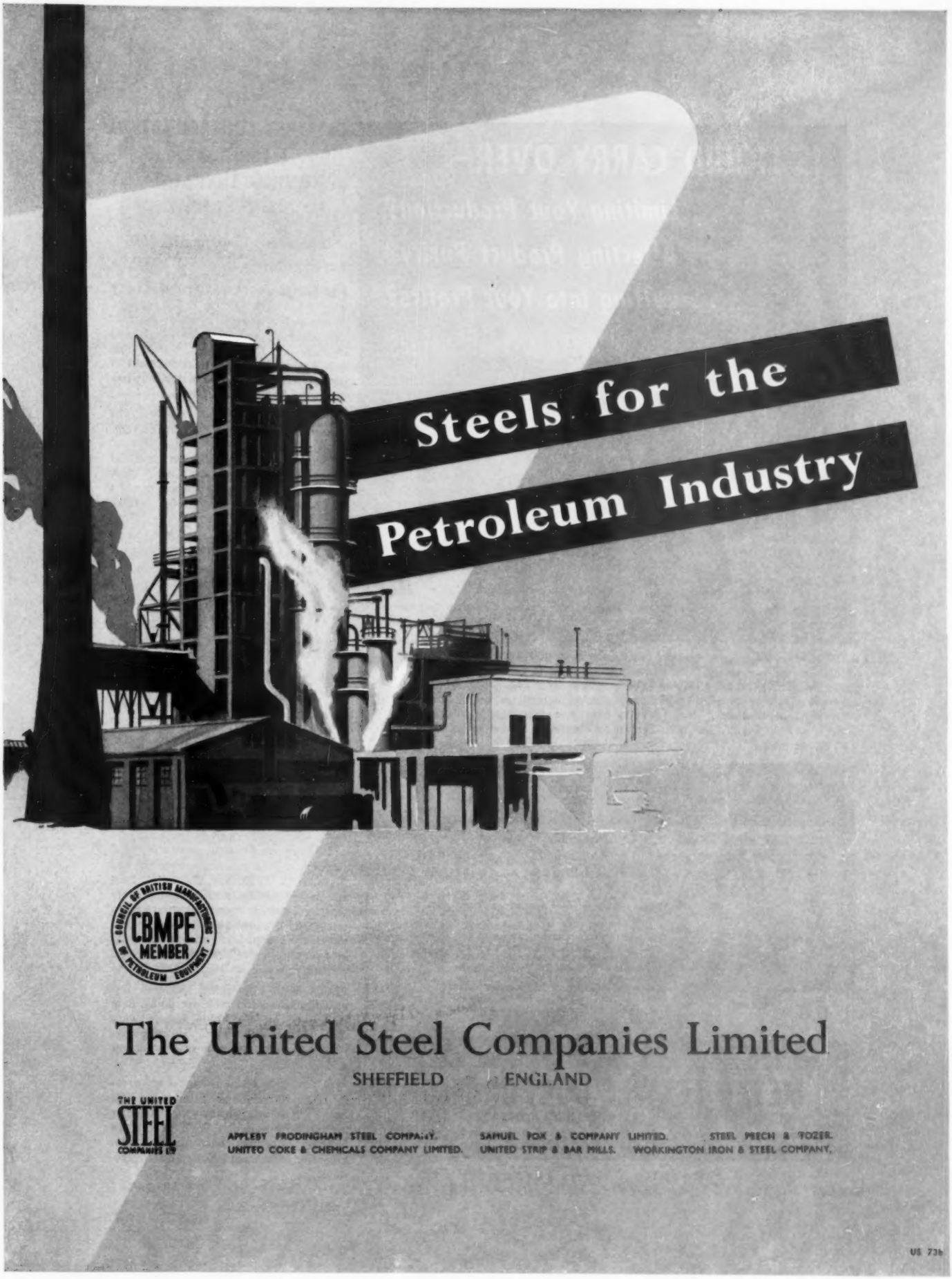
FORGED STEEL GATE VALVE. No. 1636

Available for Working Pressures of 600 lbs. and 900 lbs. at 900° Fahr. and in the following sizes—
¼", ⅜", ½", ¾", 1", 1½", 2".

Alternative ends as follows can be supplied:
Screwed Ends Ball Joint *(illustrated,)*
Socket Weld Ends Ball Joint,
Screwed Ends Gasket Joint,
Socket Weld Ends Gasket Joint.

Newman, Hender & Co. Ltd

WOODCHESTER GLOS. ENGLAND


Steels for the
Petroleum Industry
BOURNEUL OF BRITISH MANUFACTURERS OF PETROLEUM EQUIPMENT
CBMPE
MEMBER
The United Steel Companies Limited
SHEFFIELD ENGLAND
THE UNITED STEEL COMPANIES LTD
APPLEBY FRODINGHAM STEEL COMPANY.
UNITED COKE & CHEMICALS COMPANY LIMITED.
SAMUEL FOX & COMPANY LIMITED.
UNITED STRIP & BAR MILLS.
STEEL PEECH & TOZER.
WORKINGTON IRON & STEEL COMPANY.
US 73b

IS LIQUID CARRY OVER–

. . . Limiting Your Production?
. . . Affecting Product Purity?
. . . Cutting Into Your Profits?

IF SO–GET THE FACTS ON METEX MIST ELIMINATORS!

Section of a METEX MIST ELIMINATOR, opened to show construction. They can be made of practically any metal, to combat corrosion. Factory cut to fit vessel dimensions and contour, there is no limit to the size in which they can be obtained.

Liquid entrainment need no longer be considered an unavoidable nuisance in processing operations, as more and more engineers are finding from experience. These *knitted* wire mesh entrainment separators literally "filter out" the entrainment (see diagram) and permit the gas to pass on, freed from the unwanted–and often contaminating–liquid.

METEX MIST ELIMINATORS can be easily installed in new or existing vessels. They require no special housings, equipment or power–and need no servicing or attention. They function over a wide range of velocities with a pressure drop usually so low it cannot be measured. Users report efficiencies of 99% and more.

METEX Mist Eliminators can be used wherever the problem of liquid entrainment exists. By effecting complete removal of liquids, Mist Eliminators contribute to more efficient and economical processing in such vessels as:

- VACUUM PIPE STILLS
- FRACTIONATING TOWERS
- KNOCK-OUT DRUMS
- EVAPORATORS
- ABSORBERS
- SCRUBBERS
- COMPRESSORS
- SEPARATORS
- STEAM DRUMS

Write TODAY for free catalog giving complete information and engineering data. Or tell us about your SPECIFIC *entrainment problem.*

When a gas is generated in or passes through a liquid (1), it carries with it on leaving the surface (2), droplets of entrained liquid. These droplets are carried upward by the rising gas stream (3). As the gas continually changes direction in passing through the pad, the droplets are impinged on the extensive wire surface. Here the droplets coalesce, forming large drops of liquid which break away (4) from the pad and fall back through the gas stream. The gas (5) passes on, freed from liquid entrainment.

METAL TEXTILE CORPORATION

KNITTERS OF WIRE MESH FOR MORE THAN A QUARTER CENTURY

METEX

Roselle, New Jersey

CATALYST CONTAMINATION CURED BY REMOVING ENTRAINMENT IN DISTILLATION UNIT

Equipment Costing $15,000 Pays Out In Under A Week For Large Southwestern Refinery

It was not a difficult problem to trace the cause of mounting catalyst losses to a cat unit feed so poor in color that it was essentially black. Entrainment of liquid from the bottom of the still column could be the only answer.

Here was a situation where a Metex Mist Eliminator would remove the entrainment – but what else might happen? Would this knitted wire mesh separator cause excessive pressure drop? How quickly would it become plugged by coke deposits and make the column inoperable?

Calculations by one engineer showed that the total cost of installing a 25-ft diameter Mist Eliminator, including designing and erecting supports within the still, was approximately $15,000 – less than a week's catalyst loss. After considerable study the decision was made, and the Mist Eliminator installed during the next routine turnaround.

When the first run of cat unit feed came from the remodeled crude distillation unit, it was crystal clear and water white. Throughout the normal run no differential pressure across the screen was found.

The problem was solved. Catalyst losses dropped sharply. And the Mist Eliminator has paid for itself in a matter of days.

Have you really analyzed your entrainment costs, and checked the savings a Mist Eliminator could make for you? Perhaps you are losing valuable end products in the exhaust stream. Perhaps you have a nuisance contamination problem. Perhaps the entrainment created in one vessel is causing trouble in a subsequent operation. For entrainment is an inevitable result of most processing and refining operations.

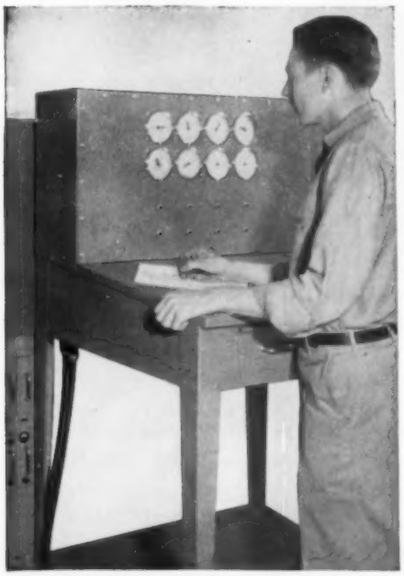
Metex Mist Eliminators perform just one function–and they are doing it in more and more refining vessels every day. They remove liquid entrainment–efficiently and economically–wherever it may occur.

Why not write today for more information on Metex Mist Eliminators. Or better yet, send data on your particular entrainment problem. We'll be glad to have our engineers check this, and send you our recommendations and suggestions.

Why TIMKEN® forging steels give you uniform, high quality forgings

THIS MICROSCOPIC CHECK of your order makes sure that Timken® forging steels have uniform grain size after heat treatment. Result: higher ductility, higher impact. This is another example of the many ways the Timken Company controls quality at every step in production.

INDIVIDUAL HANDLING of your order enables us to target conditioning procedure to your forging requirements. Your forging rejects are minimized. And you save steel because the good dimensional tolerances of Timken bars produce uniform weight multiples with a minimum of steel lost in flashings.



RIGIDLY CONTROLLED CHEMISTRY assures you of uniform composition in every forging bar. This spectrometer, for example, tells the exact composition of a melt in just 40 seconds. Results are flashed back to the furnace so the melter can maintain constant control of the heat analysis.

YOU HAVE FEWER FURNACE ADJUSTMENTS when you use Timken forging steels. Every lot responds uniformly to heat treatment because every lot has the same physical and chemical properties. Always specify Timken forging steels. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD — THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

24 ACRES *Cover the World*

. . . with TOP QUALITY

DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

by

Vogt

Air View of
Henry Vogt Machine Co.

This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

OUR COMPLETE LINE INCLUDES

Flanged, Screwed and Socket Weld End Globe, Gate and Check Valves • Ells, Tees and Crosses • Couplings • Bushings • Plugs • Unions • Flanges and Flange Unions • Welding Heads

HENRY VOGT MACHINE CO. LOUISVILLE 10, KY.

Branch Offices: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

The motor that *smothers explosions!*

You can't stop a motor from throwing sparks . . . and if there's petroleum vapor around you can't prevent the ensuing explosion. But you can make sure such explosions cause no damage —by replacing outmoded motors with Westinghouse Explosion-Proof motors wherever petroleum fumes collect. These totally enclosed, fan-cooled motors smother explosions *inside* the motor, where they do no harm.

There's no secret about how this is accomplished. Closely machined fits are designed to keep any internal flame or spark from reaching the outside of the motor. That's why you can count on Westinghouse Explosion-Proof motors to deliver *safe* as well as *dependable* performance on pumps, compressors and other constant speed equipment in drilling, pumping, pipe line and refinery operations.

Add to this important safety feature the rugged, compact construction of Explosion-Proof motors—heavy steel or cast iron frame, feet and end brackets for maximum strength and rigidity . . . long resistance to corrosive atmospheres. Exclusive "Tuffernell" insulation and wire covering of synthetic resin provide high dielectric strength and long life. For more information about Explosion-Proof motors write to Dept. U, Westinghouse Electric International Co.

For safe operation *in explosive atmospheres, Westinghouse Explosion-Proof motors are furnished with characteristics suitable for a variety of applications. One to two hundred horsepower; 2 and 3 phase; 60, 50, 25 cycles; 208, 220, 380, 440 and 550 volts. Special voltages available on order.*

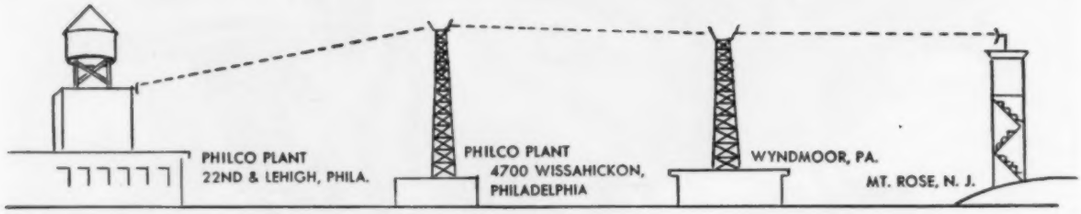
YOU CAN BE **SURE** ...IF IT'S

Westinghouse

WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY
40 Wall Street, New York 5, U. S. A.

PHILCO "PROVING GROUND" FOR MICROWAVE

Philco 160-foot microwave tower at 4700 Wissahickon . . . one of four similar Philco test sites in the Philadelphia area.



To supply industry's mounting demand for modern, efficient and private communications which do not depend on vulnerable wire lines, Philco is installing thousands of miles of new microwave for oil and gas pipelines, utilities, railroads and other major industries. Constantly improving the performance and reliability of Philco microwave equipment, each newly designed component and equipment is field tested and perfected on Philco's experimental microwave system . . . the equivalent of a 70-mile commercial installation . . . Another reason why Philco Microwave leads the field in quality, performance and reliability . . . Good reason why Philco is the world's leading manufacturer of microwave equipment.

PHILCO Famous for QUALITY the World Over

PHILCO CORPORATION

GOVERNMENT & INDUSTRIAL DIVISION • PHILADELPHIA 44, PA.

with ATLANTIC

...it's the catalyst that counts!

The Davison Chemical Corporation has teamed with The Atlantic Refining Company in the development of a catalyst for reforming straight run and cracked gasolines to a product of higher octane level. Among the important tasks delegated to Davison was the translation of this catalyst from laboratory to commercial production and at the same time impart optimum selectivity, stability, ruggedness and regenerability.

Today, Davison is producing Atlantic Platinum Reforming Catalyst on a commercial scale and shipments are being made at an increasing rate to licensees of the Atlantic Catforming Process. Davison has an outstanding record of this type of development in many fields of commercial catalyst production. If you have a catalyst problem, see your Davison Field Service Engineer or write.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

BALTIMORE 3, MARYLAND

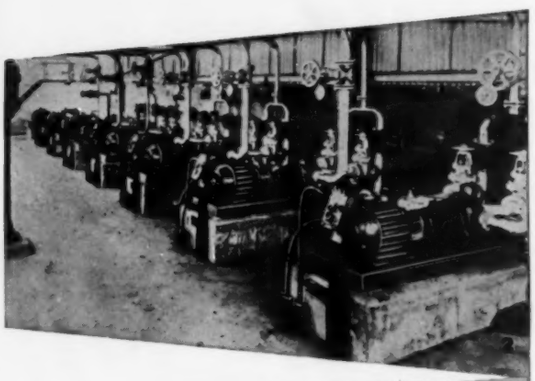
PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, TRIPLE SUPERPHOSPHATE, PHOSPHATE ROCK, SILICA GELS AND SILICOFLUORIDES. SOLE PRODUCERS OF DAVCO GRANULATED FERTILIZERS

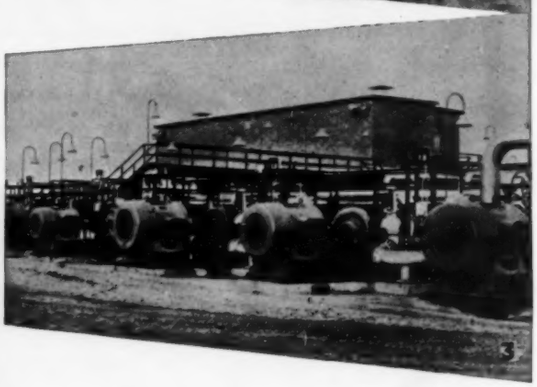
FLAMEPROOF MOTORS

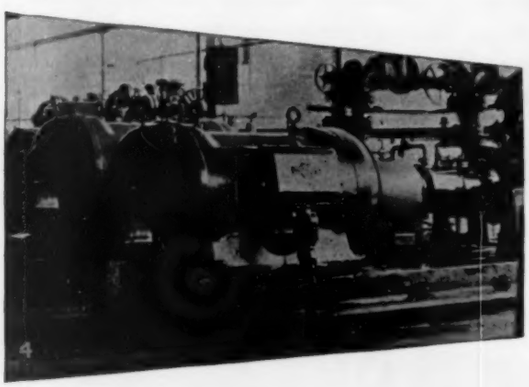
certified for group 2 and group 3 gases

A complete range of Metrovick Buxton-certified flameproof motors is available for refineries and petro-chemical works, for either indoor or outdoor use. Machines with either ball and roller bearings, or sleeve bearings, can be supplied, and all are suitable for hot product pumps.

A specialised range of splash-proof well-pump motors and industrial type machines for non-hazardous locations is also available.







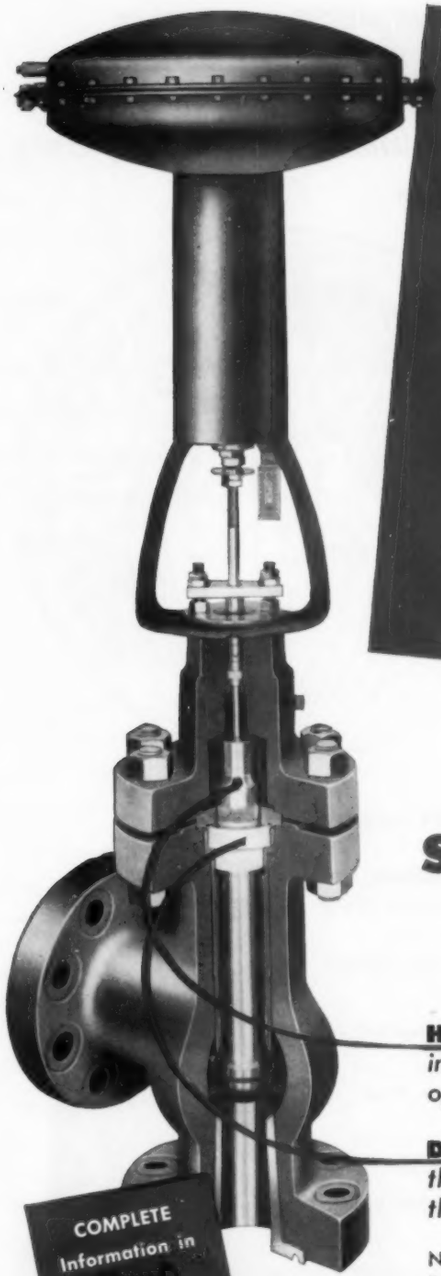
1. A range of flameproof motors in one of the main pumping stations at Scottish Oils, Grangemouth Refinery. 2. Type KFB flameproof motors driving Sigmund pumps at Shell Stanlow Refinery. 3. 300-600 hp outdoor flameproof motors at the product loading station at Esso Refinery, Fawley. 4. 125 hp 3500 rpm T.E.F.C. motors driving oil pumps at Trinidad Leaseholds, Pointe-a-Pierre Refinery, British West Indies.

METROPOLITAN-VICKERS

ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

Member of the A.E.I. group of companies

J/M301



THIS SINGLE-SEATED VALVE CONTROLS PRESSURE DIFFERENTIALS AS HIGH AS . . . . . .

3600 PSI with TIGHT SHUT·OFF

THE

HAMMEL-DAHL SEAL·BALANCED ANGLE VALVE

HOLO PLUG . . . *balanced to insure accurate positioning and optimum stability of operation.*

DAHL SEAL® . . . *eliminates leakage through the balancing port when the plug is seated.*

Nominal Sizes: 1" to 8"
Body Rating: 150# to 1500# A.S.A. STD.
Temperature Rating: To 450°F.

COMPLETE Information in Bulletin 104-B

HAMMEL-DAHL COMPANY

175 POST ROAD, (WARWICK) PROVIDENCE 5, R. I., U. S. A.

SALES OFFICES IN ALL PRINCIPAL CITIES

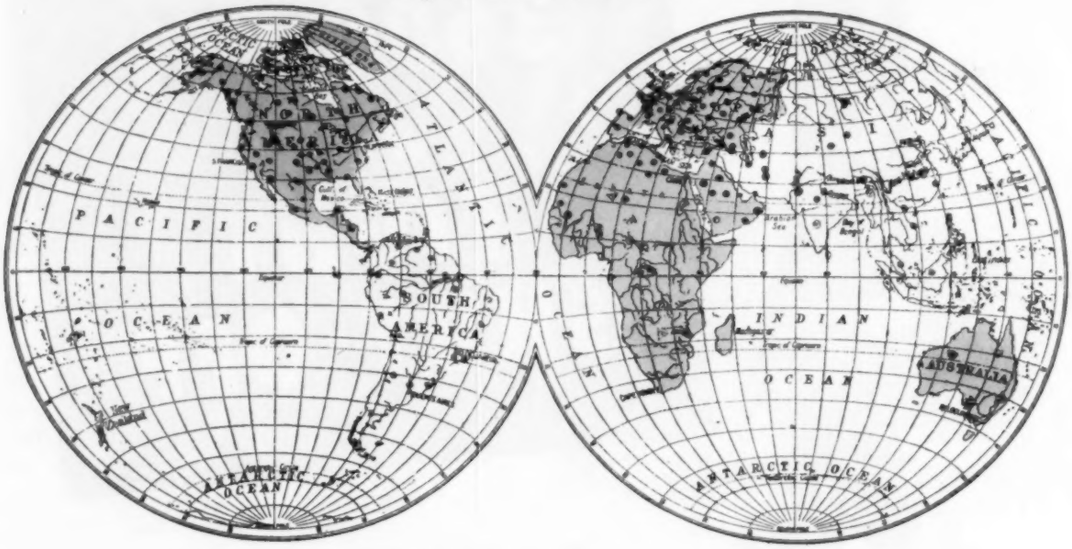
MANUFACTURING PLANTS IN WARWICK, R. I., U. S. A., CANADA, ENGLAND, FRANCE AND HOLLAND

CANADIAN MANUFACTURING AFFILIATE—GUELPH ENGINEERING CO., GUELPH, ONT.

LUMMUS

designs, engineers and constructs petroleum and chemical plants

scope: world-wide



No petroleum or chemical area in the free world is more than a few hours flying time from a Lummus office.

From principal cities on five continents, Lummus staffs have designed, engineered and directed the construction of over 700 major plants and installations.

Think of Lummus when planning your next project — location anywhere.

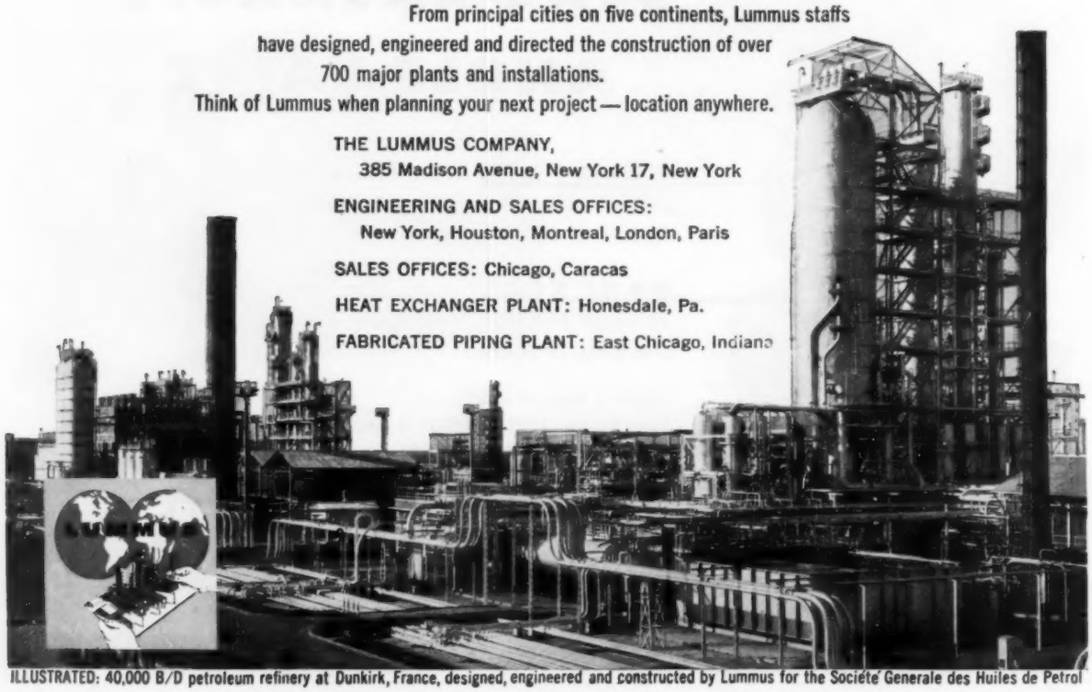
THE LUMMUS COMPANY,
385 Madison Avenue, New York 17, New York

ENGINEERING AND SALES OFFICES:
New York, Houston, Montreal, London, Paris

SALES OFFICES: Chicago, Caracas

HEAT EXCHANGER PLANT: Honesdale, Pa.

FABRICATED PIPING PLANT: East Chicago, Indiana



ILLUSTRATED: 40,000 B/D petroleum refinery at Dunkirk, France, designed, engineered and constructed by Lummus for the Société Générale des Huiles de Petrol

VOL. 25, NO. 8
JULY REFINERY ISSUE 1954

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

FOUNDED BY RUSSELL PALMER

MONA PALMER, Publisher

E. W. MAYO, Editor

J. C. CHATFIELD, Managing Editor

E. W. MAYO, JR., Sales Manager

W. E. ANDERSON, Associate Editor

J. R. TISSAVARY, Art Director

Member of National Business Publications, Inc., and Business Publications Audit of Circulation, Inc.

SUBSCRIPTIONS

Annual subscription $5.00 (U.S.) postpaid
Single copies $1.00

GENERAL OFFICES

604 Fifth Avenue, New York 20
(Tel. JUdson 6-4820)

BRANCH OFFICES

LONDON, ENGLAND

G. L. Fetherstonhaugh, St. Paul's Corner, Ludgate Hill, London E.C.4
(Tel. CITY 5318)

HANNOVER-S, GERMANY

Kurt Buge
Annenstrasse 11
(Tel. 8-4179)

LOS ANGELES 14

T. T. Drake
412 West Sixth St.
(Tel. MUtual 1391)

NEW YORK 20

Sales Representatives:
E. L. Townsend, F. K. McQuiston
604 Fifth Avenue
(Tel. JUdson 6-4820)

TULSA 3

O. F. Cozier, Mid-Continent Advertising Manager, 305 Daniel Bldg.
(Tel. 4-5555)

DALLAS 1

World Petroleum Statistical Yearbook
H. J. Struth, Editor
626 Reserve Loan Life Bldg.
(RAndolph 5515)

World Petroleum is published by Mona Palmer, Trustee under the will of Russell Palmer.

CONTENTS

57 Refining Progress Benefits Consumers

58 Aden Refinery Nearing Completion at World's Half-way Shipping Station, by E. Lawson Lomax

63 New Unifining Process a Treating Aid in Specialty Manufacturing Field

66 Hydrogenation of Heavy Coker Naphtha Prepares Feed for Sohio Platformer

71 Five Hydrofining Units Operating

74 Refining Operations in Venzuela Show 346 Percent Rise in Five Years

78 French Refinery Industry Expands, by Bernard Pene

80 Current Develöpments in Refinery Waste Disposal, by William W. Hassler

82 U. S. Refiners Continue to Build Surplus Capacity

86 Rotterdam-Pernis Refinery Largest in Europe

90 Eastern Hemisphere Review

94 Japan's Refiners Beset by Problems, by Stuart Griffin

97 German Refining Industry Sets Record of Major Progress, by Alfred M. Stahmer

100 Broad Expansion Under Way in Latin American Refining

104 Atomic Oxygen Treating Process Solves Caustic Pollution Problem

118 Six New Petrochemical Plants on Stream in Canada

128 Alumina Plant Consumes 60 Million Cubic Feet of Gas Daily

130 Trends in Petroleum Refining Patents, by Felix Heinemann and Heinz Heinemann

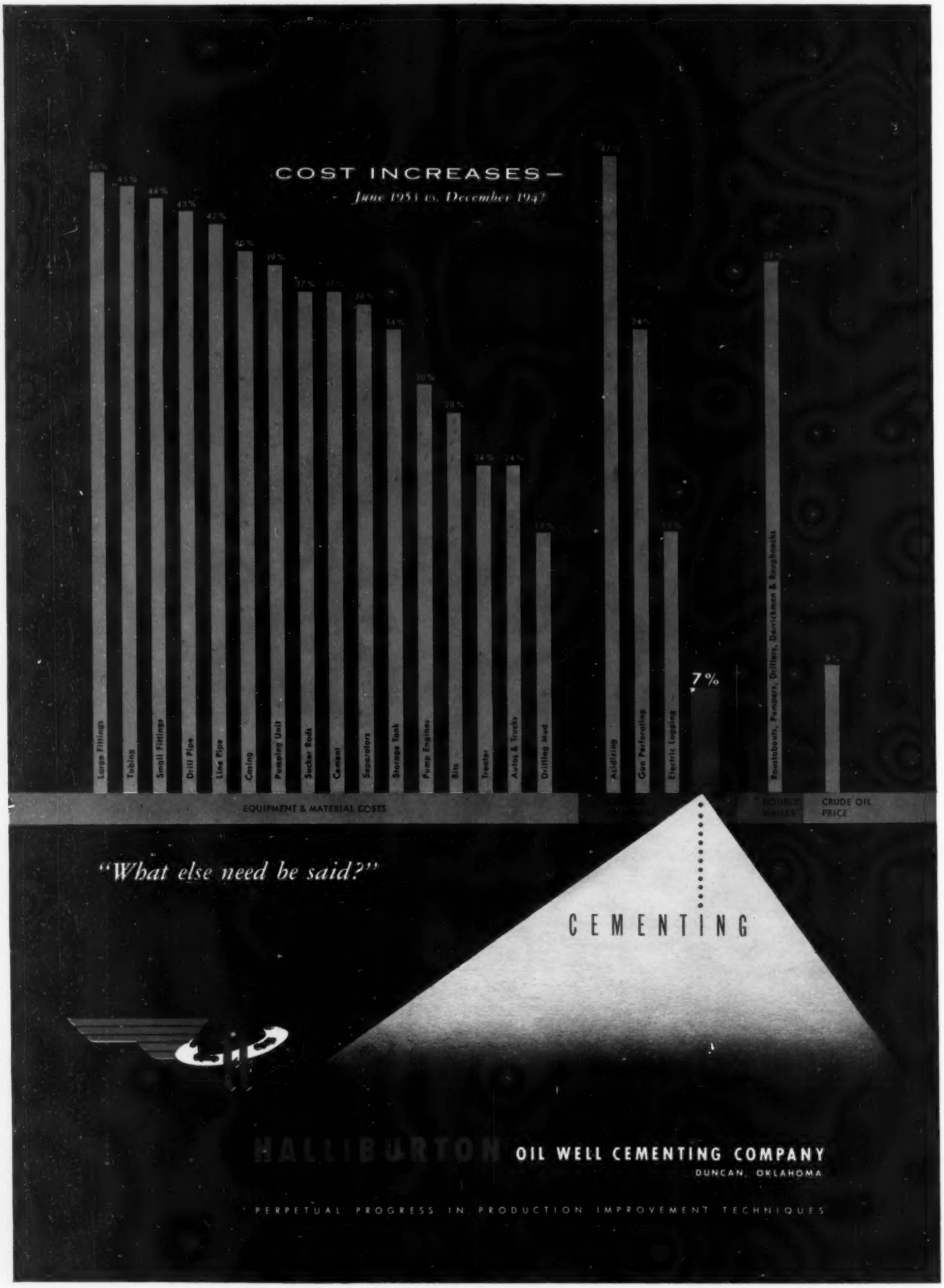
140 Oil Refineries of the World

154 Oil Company Staff Changes

194 Advertisers' Index

THIS MONTH'S COVER

Esso Standard Oil Co. is engaged in a program of painting its refineries in 19 different hues chosen both for taste and utility. Color is used to warn of hot spots and other danger areas and as a code to indicate products passing through pipes. Color applied to major processing equipment in massive areas contrasts with the code colors to give the refinery a pleasing appearance. Color plates picturing the Baton Rouge, La., cat cracker are reproduced through the courtesy of the editors of *The Lamp*, house magazine of the Standard Oil Co. (N.J.).


COST INCREASES—
June 1953 vs. December 1947
Large Fittings
Tubing
Small Fittings
Drill Pipe
Line Pipe
Casing
Pumping Unit
Sucker Rods
Cement
Separators
Storage Tank
Pump Engines
Bits
Treater
Autos & Trucks
Drilling Mud
Acidizing
Gun Perforating
Electric Logging
7%
Roustabouts, Pumpers, Drillers, Derrickmen & Roughnecks
EQUIPMENT & MATERIAL COSTS
CRUDE OIL PRICE
"What else need be said?"
CEMENTING
HALLIBURTON
OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA
PERPETUAL PROGRESS IN PRODUCTION IMPROVEMENT TECHNIQUES

Refining progress benefits consumers

ONE OF THE TRIUMPHS of the oil industry has been its success in finding petroleum to satisfy the fabulous growth in demand that has taken place in the course of its history and to meet successive emergencies as they have arisen. It is a story of daring adventure, bold risks and many disappointments, but with such a margin of success that known reserves today are greater than ever before and far beyond anything that was dreamed of even a generation ago.

No less important, though less widely recognized, is the success of the industry in improving methods of processing so that one barrel of crude can do the work performed by three in an earlier period. Without the skill, effort and money devoted to research and invention (and especially without the money expended upon it in increasing amounts which now have risen to thousands of millions of dollars yearly) it would have been quite impossible to provide the tremendous volume and variety of products required by today's industrial development and mode of life. Where once the oilman had but a single marketable product to depend on, today he has hundreds to consider and the variations, seasonal or otherwise, in the demand for some of these is such that it is essential to maintain great flexibility in processing operations.

The story of technical progress in the oil industry is one that would fill volumes, but the results are visible on every hand. Except for the development of cracking, for example, it would have been out of the question to supply the type of fuel needed to keep millions of motor cars travelling the roads, tens of thousands of airplanes navigating the air and myriad vessels plying the seas at the speeds required by the tempo of the present day. Ever since that revolutionary discovery, scientists and experimenters have been busy separating the molecules contained in a drop of petroleum and putting them together in fresh combinations to form useful new products.

The task of petroleum research is an endless one and the boundary of its possibilities apparently is limitless. On the economic side, it has exercised an influence no less important than that of maintaining an abundant supply to keep the cost of petroleum products most in demand within the reach of everyone. By developing more efficient and more economical methods of manipulating its basic materials, the industry has achieved the miracle of actually cheapening its products when judged by the standard of performance in spite of the constantly rising cost of finding oil and distributing its products. In recent years the researchers have devoted special attention to treating the contents from the bottom of the barrel, that is, residuals of low market value, and converting them to products of higher worth. By so doing, they have attained the scientific objective of directing more of each barrel of crude to superior rather than inferior usage, an accomplishment of primary importance in dealing with a substance like petroleum which is not inexhaustible in supply. At the same time, by devising simpler and more direct methods of processing and substituting automatic equipment for slower and more laborious methods, it has been able to cope with rising labor charges and to avoid a sharp increase in the price of its products such as has taken place with most other commodities. This is a tribute to the oil refining industry and to the engineering and equipment firms which have contributed to the advancement of the technology of petroleum processing.

Perhaps the most astonishing feature of the modern refinery is the tremendous tonnage of finished products produced per man per day.

Unit size is, of course, one important element. Both crude distillation and cracking units have been getting larger and larger year after year. An outstanding example is the new crude still at Gulf Oil Corporation's Philadelphia refinery which is capable of processing 125,000 barrels of oil daily. For normal operation, about as few men are required to control these huge units as would be needed for those with a tenth the capacity.

Thirty years ago the average operating oil refinery in the United States had a capacity of 7,000 barrels daily. Today the average is 25,000 barrels. The same is true to an even greater degree in other parts of the world.

An aerial view of the new refinery at Little Aden.

H.R.H. The Duke of Edinburgh talking to senior construction staff at time of recent Royal inspection.

One of the new jetties being built at the refinery site.

J. F. Brady, who is in overall charge of building the Aden refinery, consults with A. W. G. Trantor, general manager.

ADEN refinery nearing completion at world's half-way shipping station

By E. Lawson Lomax

HISTORICALLY, the port of Aden, near which the Anglo-Iranian Oil Co. is building an oil refinery of five million tons yearly capacity to begin operation in August of this year, has long been a place of importance, as it possesses the only good harbor situated on the main ocean trade route between Egypt and India.

As the half-way bunkering port on the sea route between Europe and East Africa, the Middle and Far East, India and Australasia, Aden is one of the busiest ports in the world. More than 4,500 ships call there during the year.

In Roman times and even earlier, Aden was a considerable port, and for hundreds of years Eastern trade passed through Aden, thence up the Red Sea and overland across Egypt to the Mediterranean.

With the discovery of the Cape of Good Hope route in the 15th century, the importance of Aden declined, but the opening of the Suez Canal in 1869 re-established it as a main trade route port.

Aden colony, with an area of about 75 square miles, has been under the British Crown since 1839, and consists today of the port and a shopping area known as Steamer Point; Crater, the main and original town five miles away, which is still walled; and a narrow strip of land extending around the bay as far as the peninsula of Little Aden.

The population is about 140,000, more than four-fifths being Arabs. Indians and Somalis form the two largest non-national elements in the colony, while in addition, exclusive of the new refinery construction workers, about 600 Europeans live in the colony. These latter are mainly engaged in government administration, commerce, shipping and banking.

Aden is a free port, apart from duties on alcohol, tobacco and motor spirit, and its modern commercial prosperity is based on its being a large refuelling station.

Aden Protectorate, with a population of about 800,000 and an area of about 120,000 square miles, lies inland from the colony, and is divided into eastern and western areas, comprising a large number of Sultanates and tribal chieftains in protectorate treaty relations with Britain. The interests of the Western Aden Protectorate are looked after by a small cadre of British political officers and Arab assistant political officers under a British agent, with headquarters in Aden. The Eastern Aden Protectorate is divided into several Sultanates and Sheikhdoms.

The rainfall over both the colony and the protectorate is very small and in some years non-existent. Consequently, there is little or no agriculture, except where some effort has been made at water conservation in the protectorate, where vegetable and cotton growing schemes have been instituted.

Industry is represented by the collection of salt from sea water by solar evaporation, and a small amount of light industry, mainly confined to soap and cigarette manufacture, weaving, dyeing and printing of cotton fabrics. Skins and hides from the protectorate are an export commodity.

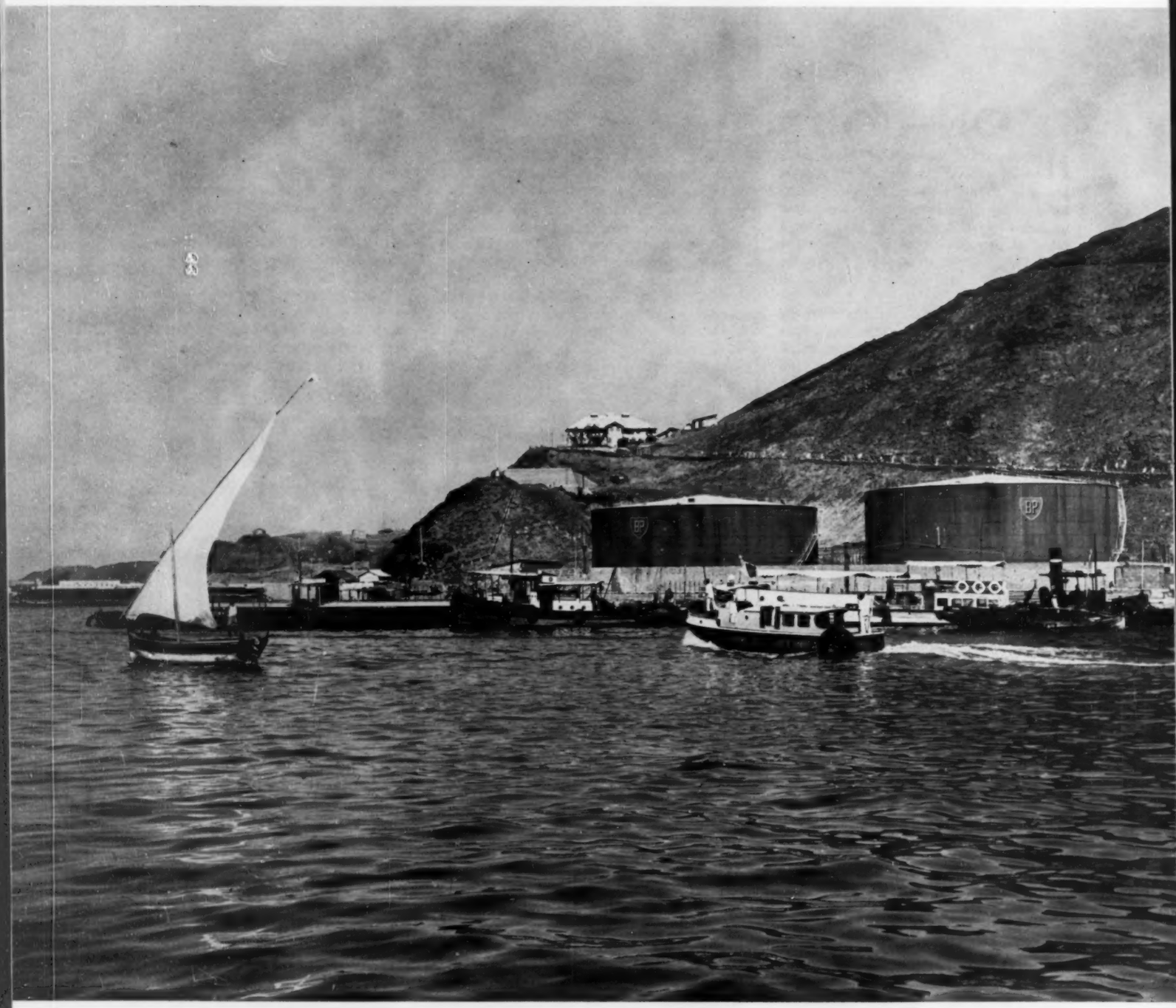
Fishing plays a part in the economy of the colony, which is also the center of a considerable trade in cured fish, a great part of the total catch from the south coast of Arabia, the southern Red Sea and Somaliland being brought in by dhow for Aden merchants to export to India and Ceylon.

The bunkering depot was opened in 1919 by B. P. (Aden), a subsidiary of the Anglo-Iranian Oil Co., and has increased very substantially since that date.

In 1950, Anglo-Iranian Oil Co. decided to include in its program of refining expansion the erection of a new major plant between Suez and India. Various areas were investigated, and late in 1951 a reconnaissance party of representatives of

Processing section of Aden plant.

As the "half-way" bunkering port of the sea route between Europe and East Africa, the Middle and Far East, India and Australasia, Aden has long been one of the busiest ports in the world. Today more than 4,500 ships call at Aden each year. Aden is one of the biggest suppliers of ships' bunkers in the Eastern Hemisphere. The demand for fuel oil supplied through BP (Aden), a subsidiary of Anglo-Iranian Oil Co., has increased very substantially since the bunkering depot opened in 1919.



Anglo-Iranian and its shipping organization, the British Tanker Co., visited Aden. After three weeks' investigation of the various possibilities, they recommended the erection of the proposed refinery on a location at Little Aden, on the west side of the bay, opposite Aden Town.

A second party visited Aden in January 1952 to carry out further surveys of the land and sea areas in which the company was interested and to test-drill in the desert for fresh water. Its work was completed in July of that year—drilling, incidentally, having proved the presence of fresh water — and a construction license was issued by the Aden government enabling work to start. Subsequently an agreement between the Aden government and the Anglo-Iranian Oil Co. was concluded.

Work on the making of the port and the erection of the refinery was begun on November 1, 1952. The contractors employed by the oil company for the refinery are: the Middle East Bechtel Corp., an American company, and George Wimpey and Co. Ltd. of Great Britain. The latter firm is also the contractor for building the oil port for which the necessary dredging is being done by a British-Dutch combine. Consulting engineers for the port construction and dredging are Rendel, Palmer and Tritton of London.

Erection of a refinery and building of an oil port on the site, which was practically barren rock with no living accommodation, called for a large amount of preliminary work, including the provision of living quarters for the construction staff and workers and provisions for feeding them, which in the main had to be imported. It also required health and supply services.

The large sum of £6,000,000 ($16,800,000) was expended on these services, including the preparation of ground and foundations, before actual building of the refinery plant and docks could be commenced.

For the first part of this work, the liner "Dorsetshire," under charter to the refinery and port contractors, took out plant and workers, and for 4½ months was anchored at Aden and used as a floating camp for about 150 men. The first work was the erection of prefabricated barrack buildings to accommodate the workers on site.

There are two main construction camps: one, known as BEA, for British, American and European workers, and the other subdivided for Arab and Indian workers. In addition, 85 family houses, prefabricated in the United Kingdom, have been built. There are two main messes, one British-American and the other for Italians, each serving their national dishes. Recreation halls, bars, snack bars, a billiard room, table tennis room, photographic room, library and barber's shop, are open during the day and evening. Messes and recreation halls are air conditioned.

Tennis courts and a football and cricket pitch have been built, and an antishark net ensures safe bathing from one of the beaches near the camp. There is also an open-air cinema which shows British, American and Italian films, usually with sub-titles in French and Arabic.

Barrack buildings, constructed mainly from local materials, have been built to accommodate Indian and Arab workers, who have their own messes, recreation halls, shops, open-air cinema and sports facilities.

Temporary buildings were used as hospital wards during the early days of construction, but by September 1953 a 200-bed hospital had been erected. This new hospital is of prefabricated design and is completely independent. There are three operating theatres, X-ray equipment, laboratories, pharmacies and treatment rooms. The kitchens are capable of providing meals for all the patients and staff, and seven or eight different types of food can be prepared according to the different nationalities or tastes of the patients. The total staff is 230, including 15 doctors and 15 nursing sisters. The camp also has a power laundry which can handle 95 tons of laundry per week and a bakery which can bake 10,000 rolls and over 1,000 loaves of bread per day.

A refrigeration plant on site has storage space for 600 tons of perishable food and an ice plant provides 11 tons of ice per day. Food is imported from 26 different countries from Norway to New Zealand, and large quantities of fresh eggs and vegetables are flown in from Aden Protectorate and Eritrea.

Fresh water for domestic use is obtained from several artesian wells drilled in the desert about six miles from the refinery site. The present wells are 250-300 feet deep, but a deep test well is being drilled to 2,000 feet. Fresh water for boiler requirements will be evaporated from sea-water, and cooling water for the refinery will be pumped from the sea and returned there through the latest type of water/oil separators.

The cost of the refinery is estimated to be about £45 million ($126 million) and its throughput capacity is five million tons of crude per year or about 10,000 barrels per day.

It is designed for the production of various fuels and burning kerosine to the following quantities:

	TONS YEARLY
Marine Bunker Oils	3,000,000
Gas Oil	300,000
Aviation turbine fuel & burning kerosine	400,000
Power kerosine	100,000
Motor gasoline	900,000

The principal markets to be served are Aden (ships' bunkers), Red Sea, East Coast of Africa, India, Pakistan and Ceylon.

The engineering and drafting for the refinery has been carried out mainly by

Prefabricated family houses for the married staff.

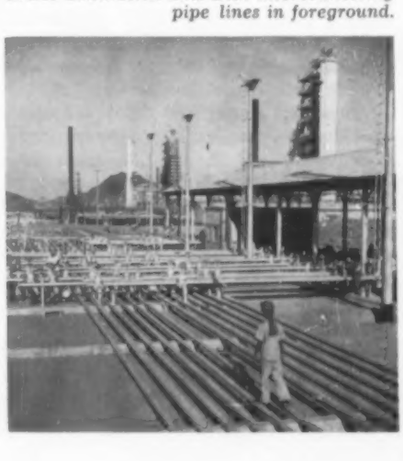
Middle East Bechtel Corp., and practically all the materials needed for the refinery are on site or nearly ready for shipping.

The main units of the refinery are the two crude distillation units, sulfur dioxide, kerosine treatment plant, Autofiner, Platformer, solutizer and copper chloride treating plants, together with auxiliary equipment.

The two crude oil distillation units working on Middle East crude will each have a throughput capacity of 60,000 U.S. barrels per day, taking off overhead gasoline, with benzine, kerosine and gas oil as side streams and a fuel oil residue. They were designed and installed by E. B. Badger & Sons Ltd., a division of Stone and Webster Engineering Corp.

The main columns of these units are 140 feet high by 16 feet in diameter, and weigh 130 tons each. They were prefabricated in three sections in France, shipped to Aden from there, lifted into place one section at a time and the joining weld then made. By using this

Crude distillation unit with interconnecting pipe lines in foreground.



method, the towers were erected in seven weeks, compared with an estimated erection time of seven months had the towers been welded plate by plate on site.

These two distillation units will be the first in the world to be electronically controlled, the control equipment having been supplied by the firm of Evershed and Vignoles. The control equipment is situated in an air-conditioned control room overlooking each unit, where the operator will be able to sit at a control desk and regulate the flow, pressure, level and temperature of the various streams passing through the plant.

The side stream kerosine from these units provides the base stock for the aviation turbine fuel, burning kerosine and power kerosine. Part of this stock is treated with liquid sulfur dioxide to remove aromatic hydrocarbons which have poor burning qualities, and these aromatic hydrocarbons, which have a high octane value, are then blended into power kerosine.

This plant and the sulfur dioxide preparation plant were designed and procured by E. B. Badger & Co. Ltd. The liquid sulfur dioxide plant is capable of treating 8,000 pounds per day of this chemical. Auxiliary plants in this section are those for stripping SO_2 from the extract and raffinate, drying it and recondensing it for further use in the process.

The power kerosine will be desulfurized in an Autofining plant. The Autofining process, for the removal of sulfur from a wide range of petroleum distillates, was developed in the laboratories of the Anglo-Iranian Oil Co. The plant, which has a capacity of 3,000 barrels per day (150,000 tons per annum) was designed by W. J. Fraser & Co. Ltd.

Heavy benzine is upgraded by treatment in the Platformer which is of Universal Oil Products design and was engineered by Bechtel.

In addition to raising the octane rating, the benzine is sweetened by the removal of sulfur compounds. The capacity of this plant is 12,000 barrels per day (600,000 tons per annum); about two-thirds of the motor gasoline is processed in it. The re-cycle gas treating column of this unit weighs over 86 tons. Final sweetening of the motor gasoline is by the solutizer process and copper chloride process with caustic soda neutralization.

A power station of 7,800 kilowatts capacity has been built for the construction phase, and in addition there is a permanent power station with three 7,500 kw turbo-generators which were supplied by Westinghouse. For providing steam to the power station and refinery, four Riley Stoker Co. Ltd. boilers are to be used with a total steam capacity of 600,000 pounds per hour.

The salt water pumphouse is installed at the power station and has six pumps, each with a capacity of one million imperial gallons per hour. Two of these pumps will be used for supplying cooling water to the refinery, two for cooling water for the power station and two will be stand-bys.

The completed refinery will require over 100 tanks for crude oil and products storage. The largest of these will be crude oil storage tanks with an individual capacity of 28,000 tons (over 200,000 barrels) and are the floating roof type as are the storage tanks for motor gasoline and kerosine. Much of the tank welding is being done by machine, which can weld in three hours the equivalent length of welding done by five men in three days.

Two 19-mile pipe lines, one 16 inches and the other six inches in diameter, will be used to pump products from the refinery to tankage at the BP international oil bunkering installation at Aden. Over two million tons of various grades of oil will be pumped to this installation — one of the largest bunkering stations in the world — per year.

"Go-devils," fitted with radio-active capsules, will be inserted in the lines at the pumping end when grades are changed. These give an automatic warning at the Aden end just before arrival and enable the appropriate valves to be operated by the man in charge, so that the products can be discharged into the right tanks and prevent contamination. Submarine pipe lines connect the Aden tanks with eight off-shore loading lines.

The oil port for the reception of crude and the dispatch of products (other than those delivered by pipe line to the Aden installation) has been provided with one finger jetty at which two supertankers can be accommodated at the same time and two T-head jetties, each providing a berth for one super-tanker.

A deep approach channel with an adequate turning circle has been dredged, an operation which entailed the lifting of about six million cubic yards of sand, the building of a 9,000-foot bund and a 4,000-foot breakwater.

The dredged sand is pumped ashore to reclaim an area of about 2,000 acres on which tanks and port offices are being erected. About 1,200,000 cubic yards of rock required for the building of the bund and breakwater has been quarried from the nearby volcanic hills.

All vertical piling and much of the diagonal piling for the jetties has been completed, as well as the concreting of a 16-foot roadway to one of the jetties.

The building of the port is the direct responsibility of George Wimpey & Co., the sub-contractors for the dredging being Dredging & Construction Co. Ltd. and K. L. Kalis Sons & Co. Ltd.

The municipality of Aden and the Anglo-Iranian Oil Co. are collaborating in the provision of housing sites, partly but not solely for the staff of the refinery, and also in the making of roads and supply of domestic water, sewage, electricity and telephones.

An arterial road is to be built between Little Aden and Aden which will reduce the road distance from 26 miles to 19 miles and will include a permanent high-level bridge some 800 feet long over the Khor Bir Ahmed and a causeway across the Aden inner harbor.

Two estates of permanent houses, initially with 100 houses each, are being developed. One is for senior staff and the second for other employees. Erection of other houses on the estates is being encouraged so as to avoid the creation of an exclusively "oil" community. The building of shops by local firms is envisaged.

The principal personnel on the spot who are engaged on this vast scheme include representatives of government, the oil company and major contractors.

Sir Tom Hickinbotham, governor of Aden, is taking a keen interest in the refinery. He has spent much of his life in the Middle East and first served in the Indian political service in Aden in 1931. He was appointed governor in 1951.

E. D. Hone, chief secretary, was previously Colonial Secretary in British Honduras. A Rhodes scholar in 1931, he entered the colonial service in 1935 and has served in Tanganyika, Seychelles, Palestine and British Honduras.

A. W. G. Trantor is general manager of Aden Petroleum Refinery Ltd., Anglo-Iranian's subsidiary company formed to build and operate the refinery. Aged 45, and a native of Aberdeen, Mr. Trantor was previously works manager of Anglo-Iranian's Kent refinery. He joined Anglo-Iranian in 1935 and for some time was chief engineer at Abadan.

R. H. Sheldrake was a member of the reconnaissance party which chose the refinery site. Since construction began, he has had extensive engineering experience and has been in charge of the building of oil installations in Iceland and Scotland.

J. F. Brady is a vice president of Bechtel International Corp., the parent company of Middle East Bechtel Corp., which, with George Wimpey & Co. Ltd. of Great Britain, is contractor for building the refinery. Mr. Brady has been connected with refinery construction projects in America and Alaska for the past 25 years and is in overall charge of the building at Aden. F. Brown, who is project manager, has been in charge of refinery construction in North and South America and Alaska.

A. Coutts of George Wimpey & Co. Ltd. is project manager of the oil harbor. He served in the Royal Engineers during the war. From 1948 to 1951 he was project manager of construction and development work carried out in Kuwait for the Kuwait Oil Co.

P. Hogan, who is deputy project manager of the oil harbor, joined Wimpey in 1937 and has been in charge of a number of construction jobs in the United Kingdom. Before going to Aden he was resident manager of London airport reconstruction.

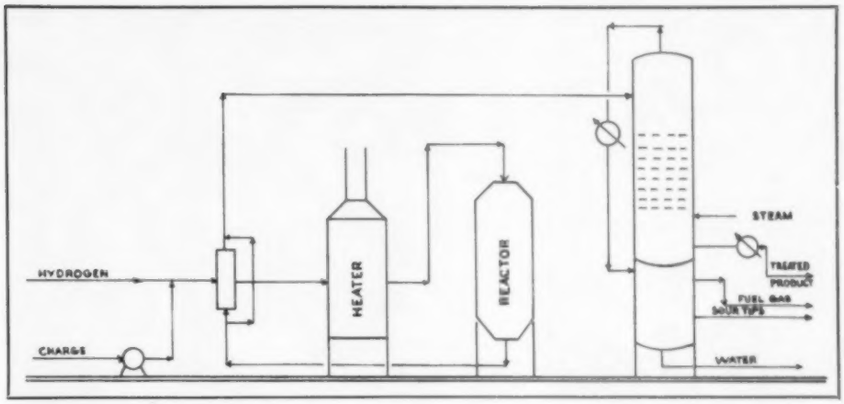


Fig. 1. Simplified flow diagram of United Refining Co. Unifining unit.

New Unifining* process a treating aid in specialty manufacturing field

UNITED REFINING COMPANY at Warren, Pa., has been operating for about five months the world's first commercial Unifining plant. Successful operation of the 750-barrel unit was announced by United last February 19. The unit has been operating regularly since that time except for normal shut downs. Hydrogen supply is obtained from United's Catformer. Stocks processed include visbreaker, naphthas, kerosine, mineral seal oil and non viscous neutrals.

Decision to install a Unifining unit by United was the result of a research program undertaken several years ago in co-operation with Elk Refining Co. of Falling Rock, West Virginia. Both companies were seeking a better method of treating kerosine for the specialty market without incurring losses encountered in acid treating. Particularly in the case of United Refining, disposal of acid sludge became a problem when an adjacent acid recovery plant was shut down.

Armour Research Institute at Chicago was selected to carry out the treating studies. The institute reported at the conclusion of its work that hydrogenation was a feasible method of accomplishing the desired result.

A small pilot plant was built at Warren and studies were made of cobalt-molybdate and other catalysts. At the same time Blaw Knox was engaged to design a commercial unit suitable for any of several catalysts being considered.

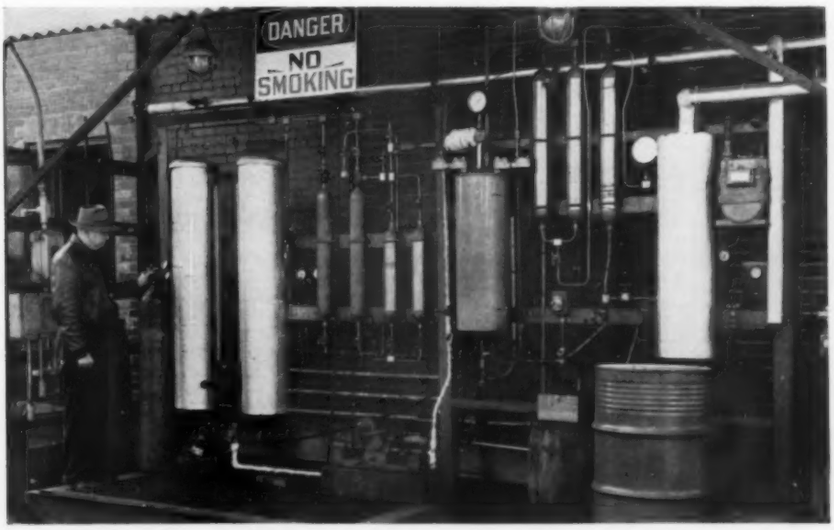


Fig. 2. Pilot plant in which proposed charging stocks are tested for Unifining.

For many years Union Oil Company of California had been working in this research field to develop a commercial process for desulfurizing and upgrading high sulfur California petroleum distillates.

Learning that Union Oil had perfected a process employing a sturdy, regenerable cobalt-molybdate catalyst, United signed a Unifining license agreement with Union Oil.

Construction of the United plant was already underway at this time by the Blaw-Knox Company. The original design had been based on the use of a second reaction step employing a second reactor containing another catalyst. The reactor has actually been installed. Thus far it has never been used, since the single vessel charged with cobalt molybdate catalyst has given satisfactory results on a number of products so that the plant has been fully occupied.

The second reactor is to be used in the near future to double the size of the Unifining unit and will be operated in parallel with the first.

Like most Pennsylvania refiners, United has found it necessary to manufacture a large number of special products in order to make a satisfactory profit. The company therefore produces special distillates for insecticide and paint manufacturers, solvents to meet rigid specifications and absorber oils of low solvency. As it has for more than a half century, the company continues to manufacture a complete line of high grade lubricants for the domestic trade and for export throughout the world.

With its own compact distributing sys-

* Trade mark of Union Oil Co. of California.

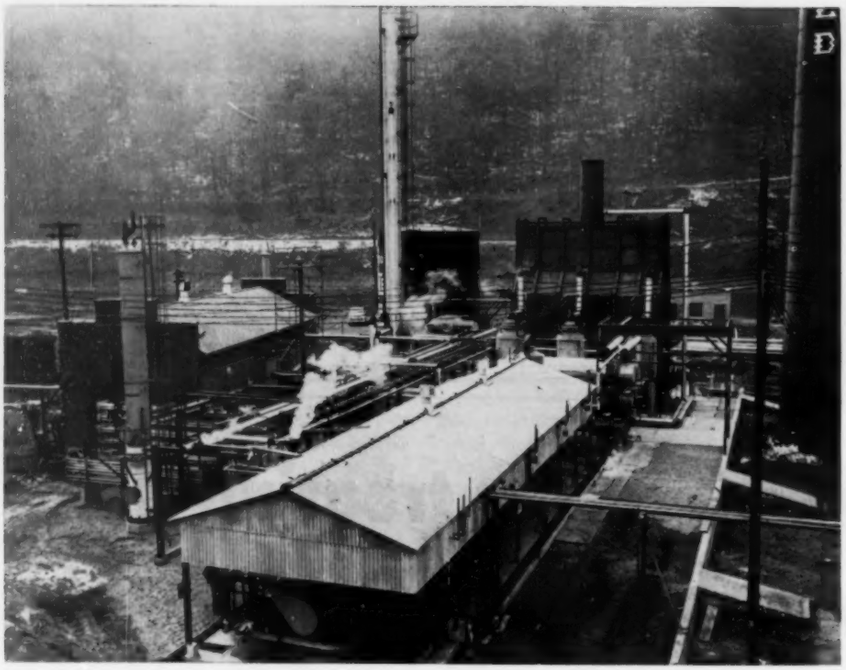


Fig. 3. General view of catformer. Reactors are between compressor building and three-section heater.

tem in western Pennsylvania and western New York, United has developed its refinery as a producer of quality motor fuel as well as middle distillates and lubes. A rounded program has involved the bringing in of western crude in growing volume to increase the production of light products over and above that available from Pennslyvania crude.

Until the end of World War II, thermal cracking and lead were enough to produce an acceptable competitive motor fuel for local markets. More recently, catalytic reforming with a 2,600 b/d Catformer has kept Keystone brand gasoline in the octane race. As this is written, the company management is planning to install a cat cracker.

Included in the new program is the installation of a vacuum unit for reducing western residuals and conversion of the Dubbs thermal cracking unit to visbreaker service. The visbreaker in combination with a new pipe still has been operating since last November. Fuel oil production is to be reduced to a minimum and vacuum still bottoms will be used to manufacture asphalts.

Although the United Unifining Unit was primarily intended to process kerosine, it has been operated on a blocked out basis for the treatment of various other stocks. The unit has proven so versatile that there is more demand for its services than capacity to meet the demand. Since excess hydrogen is available from the Catformer, it is planned to enlarge the plant by activating the second reactor.

Operating on kerosine, the Unifining unit produces a doctor sweet product of stable +30 color with very low sulfur and an olefin content reduced to about 0.6 percent. Table I shows inspection of typical kerosine charge and product. After Unifining, kerosine can be sold to insecticide manufacturers or it may be stored in off-season periods without loss of color. A less severe hydrogenation of mineral seal oil is shown in Table II. A 35 gravity neutral has also been processed by Unifining to produce a special absorption oil of the characteristics shown in Table III.

A current major use of the Unifining unit is for the processing of visbreaker gasoline to saturate olefins and reduce sulfur content. As shown in Table IV, the visbreaker gasoline is a sour and corrosive product containing 0.052 percent mercaptan and 0.203 total sulfur. It is high in gum and contains a large proportion of olefins.

Since the percentage of unsaturates is so high, it is desirable in the United Unifining unit designed for kerosine to blend about 20 percent straight run naphtha with the visbreaker gasoline. The Unifining reaction is highly exothermic and the addition of straight run limits and controls the temperature rise in the reactor.

Unifining eliminates mercaptan sulfur and reduces total sulfur to about 0.006 and 0.007 percent. Bromine number drops from nearly 90 in the combined charge to about two. Naphthene content of the gasoline is not affected so that the

TABLE I — UNIFINER OPERATION
(Charging Kerosine)

	Charge	Treated Product
Gravity	46.3	46.3
Sulfur Wt. %	0.046	0.007
Aromatics (Vol.%)	7.7	8.6[1]
Olefins (Vol.%)	7.3	0.6
Unsulfonated Residue (Vol.%)	85.3	90.0
Color (Saybolt)	+26	+30
Doctor	Sour	Sweet
Corrosion Cu.	Negative	Negative
ASTM Distillation		
IBP	355	368
10%	388	395
20%	—	405
30%	—	413
40%	—	421
50%	422	430
60%	—	441
70%	—	454
80%	—	467
90%	483	488
EP	520	520
Rec.	99%	98%
Tag Flash	138	145
Mercury Corrosion	Slight	Negative
Aniline Point	69.4°C.	72.4°C.
Kauri-Butanol Value	29.5	27.9

[1]Probably contains some cyclo olefins.

TABLE II — UNIFINER OPERATION
(Charging Mineral Seal Oil)

	Charge	Treated Product
Viscosity @ 100°	41.5	41.2
Gravity	39.3	39.6
Sulfur Wt. %	0.052	0.012
Aromatics (Vol.%)	4.4	7.1[1]
Olefins (Vol.%)	13.6	2.9
Unsulfonated Residue (Vol. %)	85.8	91.4
Color (Saybolt)	+16	+26
Doctor	Sour	Sweet
Corrosion Cu.	Negative	Negative
ASTM Distillation		
IBP	524	504
10%	542	539
20%	—	548
30%	—	554
40%	—	560
50%	564	565
60%	—	571
70%	—	—
80%	—	—
90%	596	593
EP	613	614
Rec.	98½%	98%
Flash/Fire	285/315	280/310
Refractive Index @ 25°C	1.4582	1.4568
Mercury Corrosion	Slight	Negative
Cloud/Pour	30/26/24	34/28/26
Aniline Point	84.4°C	86.0°C
Kauri-Butanol Value	22.1	21.7

[1]Probably contains some cyclo olefins.

TABLE III — UNIFINER OPERATION
(Charging 35 Gr. Neutral)

	Charge	Treated Product
Viscosity @ 100°F.	55.3	55.2
Gravity	35.2	35.5
Sulfur, Wt. %	0.08	0.030
Aromatics (Vol. %)		5.5
Bromine No.	10.8	4.7
Unsulfonated Residue (Vol.%)	77.7	86.3
Color N.P.A.	D-1	
Color Saybolt	—3	+5
Doctor	Sour	Sweet
Corrosion		Negative
Flash/Fire	345 Flash	320/370
ASTM Distillation		
IBP	619	573
5%	—	615
10%	626	620
20%	629	—
30%	630	633
40%	633	635
50%	635	637
60%	637	639
70%	640	641
80%	644	643
90%	649	644
EP	658	669
Rec.	98%	98%

product becomes a highly satisfactory charge for the Catformer.

Figure I is a simplified flow diagram of the Unifining unit as installed at United. Raw feed is mixed with hydrogen and heated in exchange with the reactor effluent. Any additional heat required is supplied by a small vertical heater before charging to the reactor.

At the United plant the gas separator is combined with a steam stripper in a single vessel. Hydrogen sulfide formed in the reactor is withdrawn from the lower segment of the tower and burned as fuel. Plant product is removed as bottoms from the steam stripper.

The Unifining unit was designed to operate at moderate pressures and temperatures. Alloys were employed where necessary throughout the system to prevent corrosion and hydrogen embrittlement. As mentioned previously, it has been possible to control heat evolved in saturating highly olefinic naphthas by diluting the charge with straight run. No such diluent is necessary in the case of kerosine, mineral seal oil or neutrals. When processing these oils containing seven to 14 percent olefins, it is necessary to heat the charge to obtain a proper reactor temperature.

United's plan to enlarge its Unifining unit will be consumated when the proposed cat cracker is installed. Added capacity will be used partly to improve catalytic cycle stock by sulfur removal and saturation of olefins. As pictured in Figure II, a small pilot plant is operated continuously in connection with the Unifining operation to determine the effect of processing various oils produced by United. Hydrogenation of waxes as well as lighter products has been studied. In general, the pilot plant has become a useful tool in planning operation of the Unifiner in its day-to-day tasks.

The catalytic reformer installed by United is a three-reactor fixed bed unit licensed by Atlantic Refining Company, designed and built by Blaw Knox Co. The platinum-bearing catalyst is regenerated in place as required by carbon accumulation. Catalyst activity is improved and extended by treating recycle hydrogen for sulfur removal in an amine unit as well as by Unifining thermally visbroken stocks. Clark Brothers opposed-cylinder hydrogen compressors are electrically driven by Louis Allis motors. A single heater is used to supply primary heat of reaction and to reheat the charge between the second and third reactors. Heater coils are individually controlled.

Hydrogen production of the 2,600-barrel reformer approximates 1,500,000 standard cubic feet per day, which is perhaps double the present needs of the Unifining unit when processing high olefin stocks. On middle distillate runs the excess hydrogen is much greater.

United Refining Company's experience with the first commercial Unifining unit over a period of five months has shown that mild hydrogenation is a useful tool in avoiding treating losses, upgrading specialty products and in increasing the volume of suitable charging stock for catalytic reforming.

A license to use the Unifining process may be procured through either the Union Oil Co. of California or Universal Oil Products Company.

Fig. 4. Unifining reactors. Only one reactor now is in service. Second vessel will be used to increase capacity.

Fig. 5. Only a small heater is required to bring Unifining charge up to reaction temperature since process is strongly exothermic.

TABLE IV — UNIFINER OPERATION
(Charging Mixed Naphthas)

Gasoline Charge — 80% — Visbreaker Gasoline
20% — Straight Run Gasoline
Hydrogen Gas — 1,500,000 cubic feet per day
Analysis of Hydrogen Gas — 93% H_2 — 0.5 Grain/100 cubic feet.

	Charge Visbreaker Gasoline	Charge S.R. Gasoline	Combined Charge	Stripper Bottoms	Stripper[1] Overhead
Gravity	62.3	65.3	62.7	57.8	75.6
ASTM Distillation					
IBP	95	96	108	173	88
5%	123	128	135	208	106
10%	141	146	150	222	115
20%	172	174	—	236	128
30%	197	196	203	248	141
40%	221	216	226	260	158
50%	242	232	246	273	171
60%	260	250	262	281	187
70%	281	267	279	299	206
80%	296	288	301	312	229
90%	328	318	328	336	269
EP	375	358	373	401	319
Rec.	98%	96%	97%	99%	96%
Vapor Pressure	8.8	11.0	8.2	0.6	12.4
Doctor	Sour	Sour	Sour	Sweet	Sweet
Corrosion	Positive	Positive	Positive	Negative	Negative
Color	—2	+30	+1	+16	+30
Mercaptan Sulfur	0.052%	0.008%	0.043%	0.001%	0.0%
Total Sulfur	0.203%	0.037%	0.178%	0.006%	0.007%
Aromatic & Olefins	54.5	9.3	44.6	9.1	9.6
Bromine Number	89.9	2.5	71.4	1.9	1.9
Cu. Dish Gum	298.0	5.0	227.0	14.0	0.0
ASTM Gum	10.0	0.0	10.0	8.5	0.0
Octane Straight	71.1	57.6	69.6	36.7	66.4
Octane with 3.0 cc	82.0	76.3	80.9	67.0	83.4

[1]Caustic washed in laboratory.

Hydrogenation of heavy coker naphtha prepares feed for Sohio Platformer

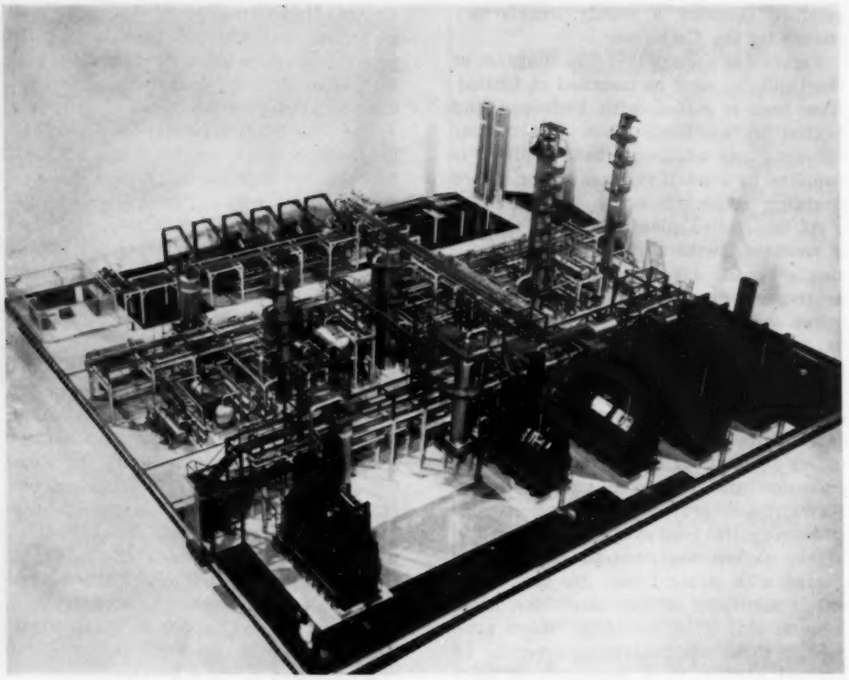


Figure I. Scale model of the Sohio Hydrobon-Platformer which was erected in the drafting room while engineering design work was in progress. The method employed resulted in substantial savings in plant investment.

NEARLY THREE QUARTERS of a century ago, in 1881, John D. Rockefeller built the first refinery at Lima, Ohio, to produce high-sulfur crude oil from the newly discovered western Ohio and Indiana fields. This year The Standard Oil Co. (Ohio), Mr. Rockefeller's original Standard company, is completing another step in a construction and modernization program begun at Lima at the close of World War II. When the job is complete later this year, the plant will be able to process 50,000 b/d to produce maximum yields of light and middle-of-the-barrel distillates and minimum quantities of fuel oil.

Sohio has spent close to $50 million at Lima since the end of World War II. Previously erected major facilities include a vacuum crude still, a combination crude still and coking unit and a UOP fluid cat cracker. This year Sohio will improve the potential octane rating of its gasoline by completing a $7,100,000 Platformer equipped with a Hydrobon unit to hydrogenate the charge stock. In addition, 60,000 barrels of underground storage for LPGas is being excavated to permit off-season storage of propane. With these two jobs done, the refinery will be, in effect, an entirely new plant when compared with its pre-war status.

Changes in refinery processing techniques over the years are high-lighted by what has happened at the Lima refinery. The Platformer will be the third oil processing unit to occupy its particular site since Rockefeller first began building at Lima 73 years ago. Then it was desired to produce kerosine which would burn without smoking the lamp chimneys or creating an odor in the parlor. Today the goal is motor fuel of high octane and good lead susceptibility.

The new Platformer unit now nearing completion will have a charging capacity of 13,000 b/d of raw virgin and cracked naphthas. It will become one of the first Platformers to be integrated with a hydrogenating treating unit.

The petroleum industry has been intrigued with the possibilities of hydrogenation for many years. Shortly after World War I, when oil supplies appeared to be entering an era of shortage, a great deal of work was done in an effort to develop a hydrogenation process to produce more light products from a barrel of crude. Unfortunately for the researchers of those days, the process was "born 30 years too soon." Hydrogen was much too expensive and wildcatters found Seminole, Oklahoma City, East Texas and other prolific fields which made the process unnecessary as well as uneconomic.

Development of catalytic reforming of naphthas in the past five years has changed the situation. In catalytic reforming, a primary reaction is the dehydrogenation of naphthenes which pro-

duces very large volumes of by-product hydrogen. Depending on the naphthene content of reformer charge stock, the various processes give the refinery 500 to 700 or more cubic feet of hydrogen for every barrel of naphtha. Availability of so much hydrogen has set researchers working so that the valuable by-product need not be burned under stills.

In its annual refinery review number a year ago, WORLD PETROLEUM described work which had been done in Germany, England and in the United States to utilize hydrogen. In Germany Scholven-Chemie A.G. was reported to be hydrofining 18-20,000 tons of benzine per month to remove sulfur, oxygen and nitrogen compounds. The commercial plant then in operation was based on patents dating back to 1925. Described in the same issue was the work done in England by Anglo-Iranian Oil Co. and Royal Dutch/Shell interests in Holland and England and the Platreater of Universal Oil Products Co. installed at Roosevelt Oil and Refining Co. in Michigan. Both Shell and AIOC processes now are in commercial operation in England.

A new development of the past year has been the announcement of Standard Oil Development Co. that Jersey Standard and affiliated companies are installing a number of Hydrofining units in the United States, England, France, Germany and Canada. Five Hydrofiners now are operating, as described elsewhere in this issue.

By-product hydrogen from catalytic reforming still is not being considered for large-scale hydrogenation of heavy oils to increase the production of lighter products. The available volumes are not considered adequate for such use. It is thought that production of hydrogen in other ways would be necessary. Aside from desulfurization, removal of nitrogen, oxygen and certain metals and hydrogenation of olefins, attention is being given in some quarters to the production of ammonia from by-product hydrogen. Recent research has shown that nitrogen compounds found in certain distillates are hydrogenated to form ammonia and various hydrocarbons of more familiar structure. Because of the low concentration of such nitrogen compounds in most feed stocks, the commercial production of ammonia as a by-product is not feasible.

Hydrogenation has been proposed for the treatment of gasoline, kerosine, stove oils, diesel fuel and for high sulfur gas oils, coker distillates and catalytic cycle stocks.

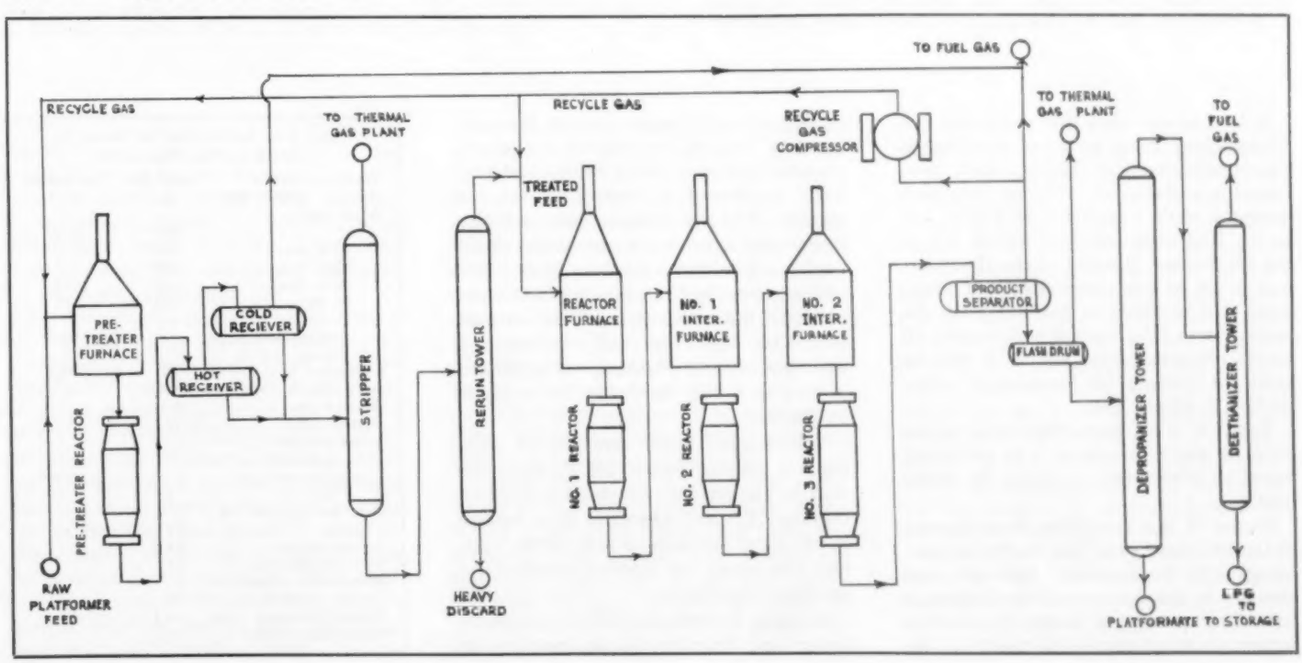
At the new Sohio unit at Lima, the Hydrobon unit charge will consist of of a mixture of coker distillate and virgin naphthas. It is expected to charge about 3,500 b/d of virgin crude still naphtha, 6,500 b/d of coker distillate and 3,000 b/d of outside feed stock to be brought in from nearby refineries.

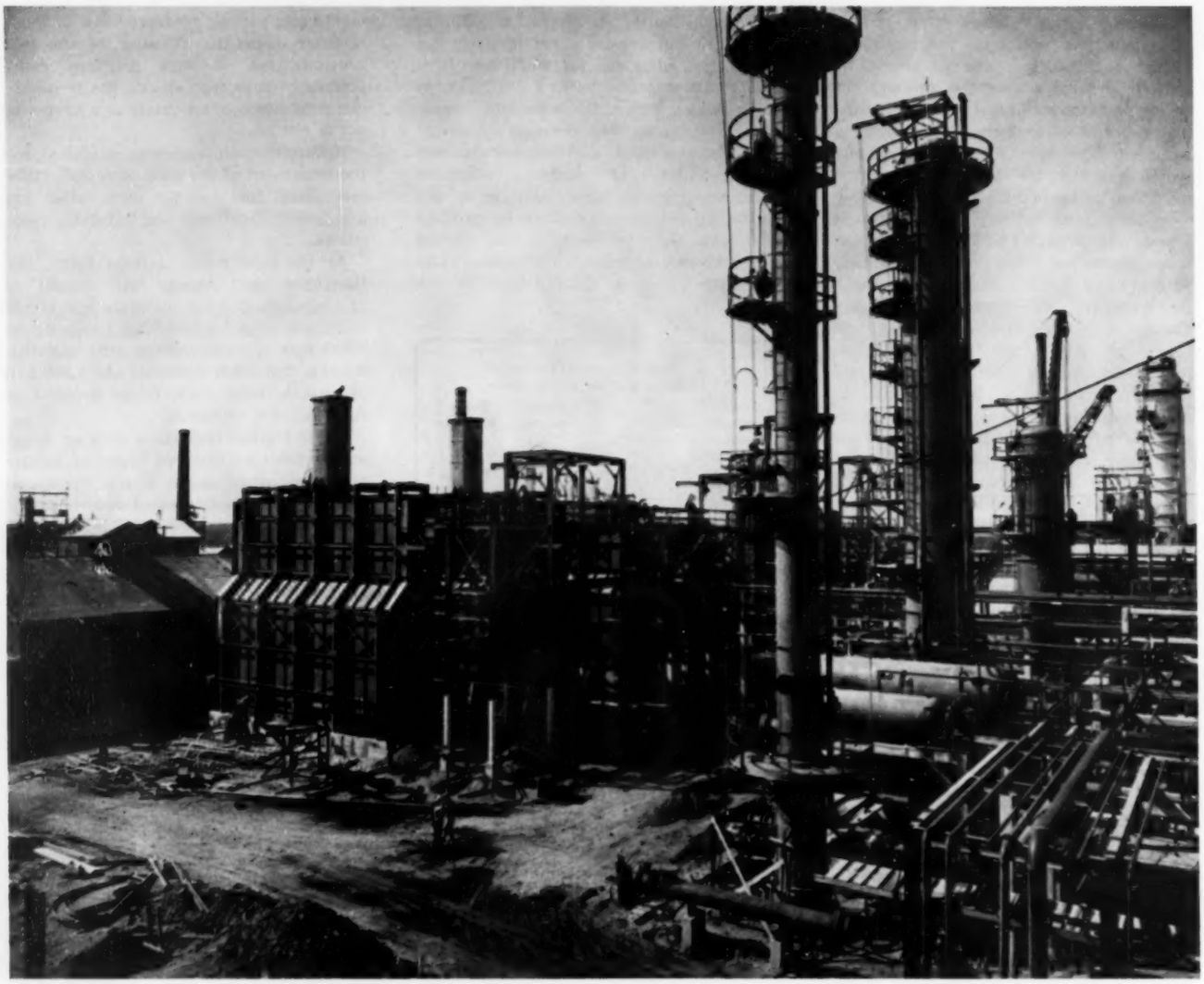
Table I gives inspection data on average streams of the two types of locally produced naphthas. It is not known at this moment what types of outside naphthas will be imported. The local stocks also tend to vary widely depending on crude sources. Lima processes crudes from such diverse fields as Illinois, Oklahoma, Arkansas and Mississippi. Total sulfur content of coker distillate from some crudes may be much higher than shown in the table. Some runs reveal sulfur content of as much as 0.244 percent by weight. Olefin content also may be as high as 54 percent in some coker distillates. The stocks shown are particularly desirable for Platforming because of the high percentages of naphthenes which may be dehydrogenated to produce high octane aromatics such as benzine, toluene and xylenes.

TABLE I — INSPECTIONS
Proposed Unifiner Charge Stock

Sample Identification	Virgin Naptha	Coker Distillate
Gravity °API at 60°F.	56.1	53.0
ASTM DIST.		
IBP	146°	218°
2% Rec.	182°	230°
5% Rec.	197°	242°
10% Rec.	202°	252°
20% Rec.	219°	269°
30% Rec.	244°	282°
40% Rec.	256°	297°
50% Rec.	267°	312°
60% Rec.	280°	329°
70% Rec.	295°	352°
80% Rec.	302°	373°
90% Rec.	330°	404°
95% Rec.	346°	422°
E.P. Rec.	361°	452°
% Rec.	97.8	98.5
% Res.	1.0	1.5
% Loss	1.2	0.0
TOTAL SULFUR — Wt. %	0.035	0.123
HYDROCARBON TYPE		
Vol. % Aromatics	6.0	11.9
Vol. % Olefins	2.1	12.1
Vol. % Naph.	36.9	18.2
Vol. % Pff'n.	55.0	57.8
F-1 OCTANE	49.2	

Figure II. Simplified flow diagram of Sohio unit.





Progress view of Sohio plant taken April 20. Work is expected to be completed and the plant placed on stream about September 1.

It will be observed that the coker distillate which Sohio proposes to charge is considerably heavier than is usually processed in a Platformer. The unit has been designed with a capacity of 13,000 b/d to the Hydrobon unit and 12,000 b/d to the Platformer. Product of the Hydrobon unit is to be prefractionated and about 1,000 b/d removed as bottoms from the rerun tower. This stream will contain all product boiling above 400°F. It will be used for furnace oil blending or other middle distillate uses.

Table II gives inspection data on the stove oil and Platformate to be produced, based on pilot plant results of the Sohio feed.

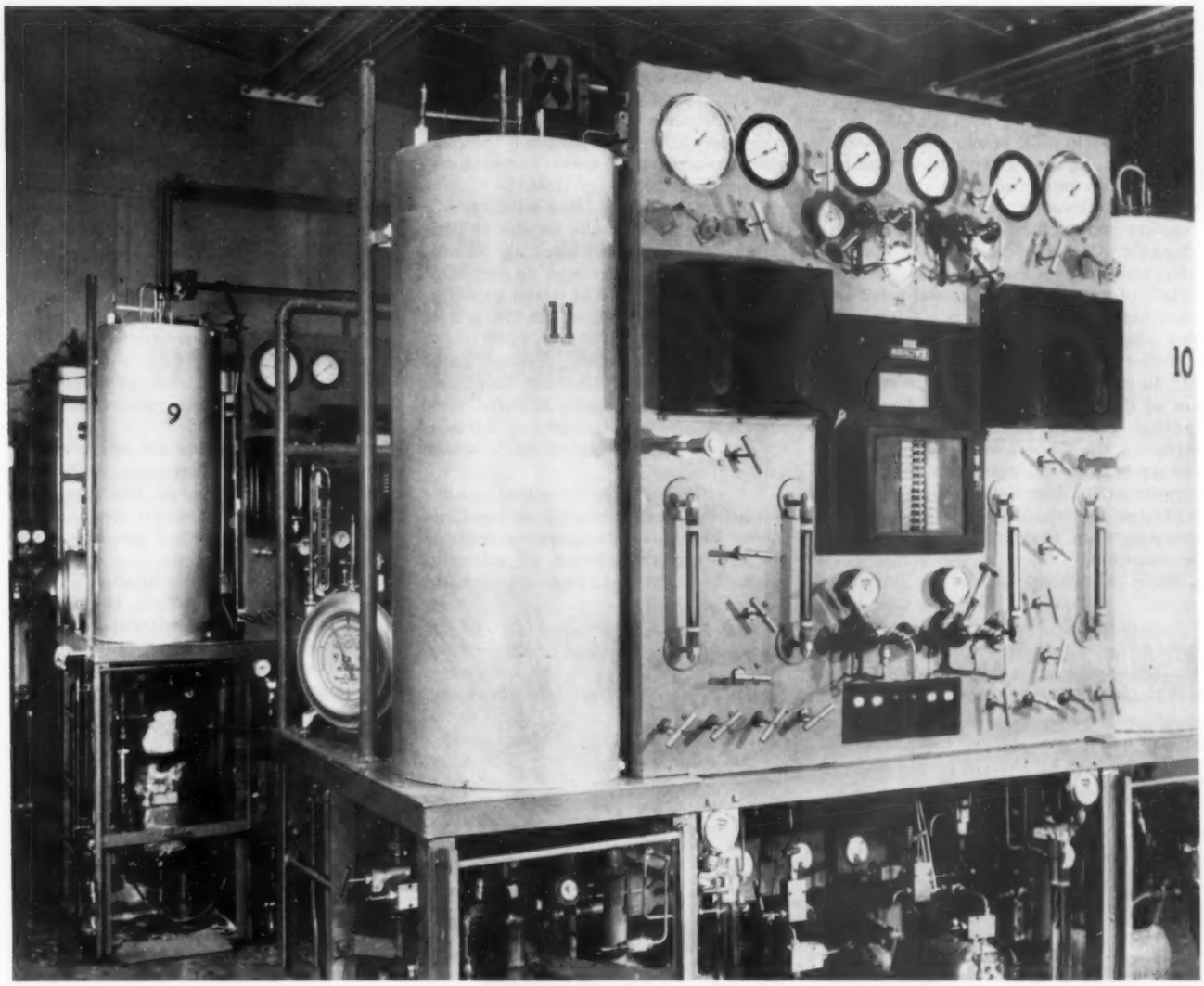
Figure II is a simplified flow diagram of the combined unit. The charge is combined with the necessary hydrogen and charged to the furnace of the Hydrobon unit. The material is heated to reaction temperature and charged to the top of the reactor where it passes through the catalyst bed. The reactor effluent is heat exchanged and after being cooled and partially condensed is flashed in the hot receiver. The hot receiver gases are further cooled to condense essentially all the naphtha. The cooled mixture flows to the cold receiver and the liquid is combined with the hot receiver liquid as stripper feed. Gas from the cold receiver is a hydrogen-rich, low heating value gas and is used as a fuel for firing the furnaces on the unit.

The stripper tower removes all components boiling below 200°F. from the charge. The stripper overhead gas, which contains H_2S and ammonia plus various butanes and pentanes, is sent to the thermal gas plant for further recovery of gasoline components.

Stripper bottoms is fed to the rerun tower and fractionated to prepare an

TABLE II — INSPECTION OF PRODUCTS
(Based on Pilot Plant Data)

Product Stream	Stove Oil	Platformate
Gravity, °API at 60° F.	42.8	51.3
ASTM DIST.		
IBP	425°	115°
10% Rec.	429°	170°
50% Rec.	437°	274°
90% Rec.	460°	353°
EP Rec.	506°	433°
RVP		7.5
F-1 octane, clear		91.0
F-1 octane, +3 cc TEL/gal		98.8
Sulfur, wt %	0.023	
Bromine No.	0.5	
Saybolt color	+20	
Steam jet gum		
As produced	1	
After 4 months at 100° F.	1	
Visc., Univ., at 100° F., sec.	32	
Cetane number	56.3	
IPT smoke pt., mm.	22	
Ramsbottom carbon on 10% bottoms	Nil	
Carbon/Hydrogen ratio.	6.26	
Kauri-Butanol value	31.1	



High pressure bench-scale apparatus used by Union Oil Co. of California in the development of Unifining at its Brea laboratories.

overhead product with a 400°F endpoint. Rerun tower overhead material is the treated charge to the Platforming section. The bottoms product from the rerun tower is the heavy distillate which on design is a 400°F. material which has been hydrogenated and is now suitable for furnace oil blending.

The reactor charge pump takes suction on the Platformer charge drum (rerun tower reflux drum) and pumps the feed stock to the feed exchangers. Recycle gas is added to the reactor charge at this point. The combination is preheated by exchange with Platformer reactor effluent. The preheated combined Platformer feed is then charged to the two reactor charge furnaces and raised to reaction temperature. From the charge furnaces the material is charged to the No. 1 Platformer catalyst reactor. Intermediate heaters between the second and third reactors are UOP upflow units.

Heat in the Platformer reactor effluent is utilized to provide preheat for the Platforming section charge. It is then cooled in the products condenser and flashed in the products separator drum. The gas from the products separator consists of a large volume of hydrogen-rich recycle gas plus the net hydrogen make gas which is formed in the dehydrogenation reaction. This net make gas is the hydrogen used in the Hydrobon unit. The recycle gas from the products separator drum is compressed and returns to combine with the fresh treated naphtha charge to begin the cycle again.

Liquid from the products separator flows to the low pressure flash drum where it is again flashed for hydrogen removal. Some gasoline and butane are lost in this operation, so that the flashed gas from the drum is combined with the stripper off-gas and flows to the thermal gas plant absorber.

Liquid from the low pressure flash drum is pumped to the depropanizer where the bottoms, depropanized Platformate product, goes to storage. The overhead liquid product, propane and ethane, is charged to the deethanizer where specification LPGas goes to storage as bottoms product. Uncondensed vapors from the depropanizer reflux drum are recycled to the low pressure flash drum. A portion of the propane bottoms product is recirculated to the overhead condenser of the depropanizer to aid condensation of the reflux in the depropanizer reflux drum. The deethanizer overhead product is put to the Platformer fuel gas system to be burned with the cold receiver off-gas as fuel.

Figure I is a photograph of a scale model of the combination Hydrobon-Platformer as being erected at Lima. The model was built on a scale of ¼ inch to the foot and cost about $7,500 to build.

Model building was done in the drafting room while the unit was being designed. It is felt that the model saved a substantial amount of money due to ideas which were developed during the engineering work.

In the Sohio unit, reactors are erected beside the original heaters rather than in a battery to minimize alloy piping. An elevated walkway is provided between all reactors and certain drums to minimize climbing. A scale model of a 6-foot operator was used to check on permissible height of valves, etc. The model aided in ensuring clearances for catalyst removal and other maintenance operations.

Referring to the photograph (Figure I), the two parallel Platformer heaters are at the right and the Hydrobon unit preheat furnace is at the left. A roadway separates the heaters and reactors from the exchanger and fractionating group. Towers shown from left to right are the Hydrobon unit charge drum, the stripper column, rerun tower, depropanizer and deethanizer.

Hydrogen storage drums for start-up are shown in the upper right hand corner of the Platformer plot. Other units beyond the second roadway are the compressors and control house. Designers of the unit moved the control house from its normal location to the point shown at the upper left in order to maintain the compact arrangement of towers and exchangers and to reduce alloy lines.

Purpose of Sohio's Lima installation is to produce a maximum volume of Platformate for motor fuel blending. No aromatics are to be recovered as such. Operating on 13,000 b/d of mixed naphthas, it is planned to produce 10,750 b/d of 7.5-pound RVP Platformate, 1,000 b/d of sweet heavy distillate boiling above 400°F, 425 b/d of LPGas, and 7.5 million cubic feet of fixed gases. A liquid yield of 93.6 percent is anticipated on the basis of severe Platforming to high octane rating.

It is anticipated that there will be some surplus hydrogen produced by the Platformer in excess of the quantity required for hydrogenation. Based on estimates given above, the Platformer will produce about 600 cubic feet per barrel of throughput, making available about 570 cubic feet per barrel of charge. In a recent paper* it was shown that chemical hydrogen consumption in a similar operation may range from about 100 cubic feet per barrel of low sulfur, low bromine number charge to as much as 800 cubic feet in processing a high sulfur stock such as Santa Maria coker distillate. A visbreaker distillate somewhat similar to that produced from Sohio's coker showed a hydrogen consumption of 330 cubic feet per barrel in pilot plant runs. It is calculated that six to eight cubic feet of hydrogen is required for each unit reduction in bromine number and 50 to 100 cubic feet for each unit of reduction in weight percent of sulfur. Other requirements are small.

Although processing temperatures may rise to 800°F and pressures as high as 1,000 psig, little or no cracking takes place in the Hydrobon unit. Result is that volumetric yields often are above 100 percent.

Cost of the entire installation at Lima will be about $7.1 million. The stripped down Hydrobon unit without auxiliaries and storage will cost about $1 million and the Platformer about $3 million. The boundary limit cost of the Hydrobon unit is about $77 per barrel of charge, which is lower than that estimated for smaller units where the investment may run as high as $175 per barrel.

Investment in Hydrobon catalyst is far less than that in catalytic reformers employing platinum bearing catalysts. It is a rugged type of material with an anticipated long life. Effect of adding the pretreating step to Platforming is expected to increase considerably the life of the platinum catalyst.

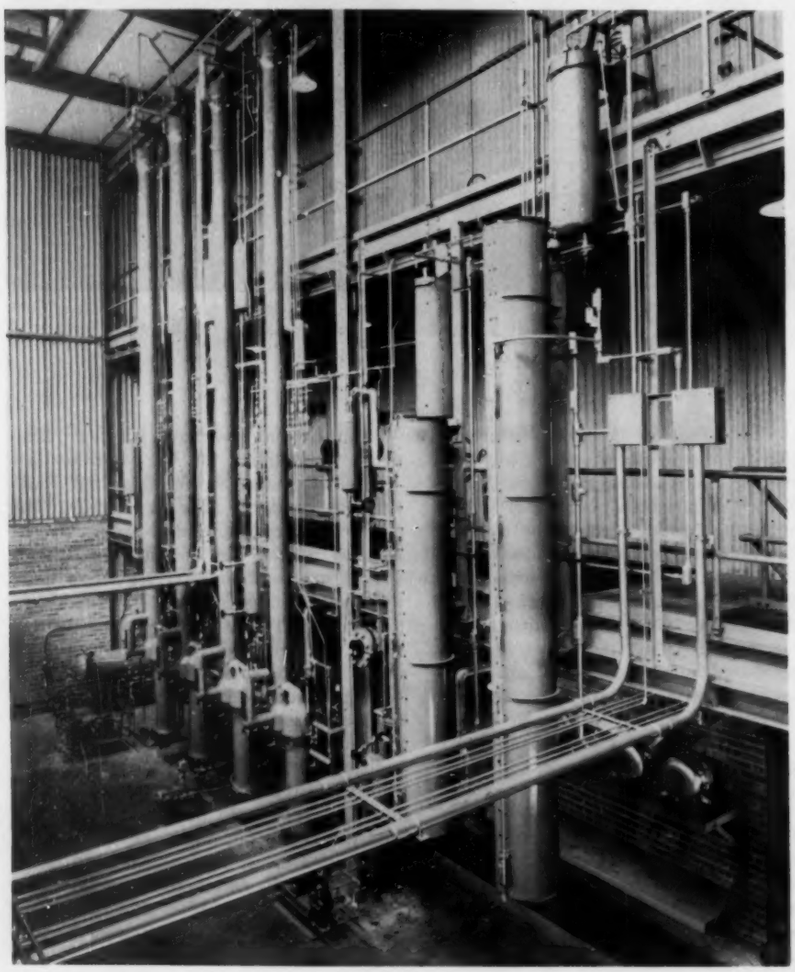
Operating costs of a hydrogenating treating unit were estimated at 8.1 to 11.9 cents per barrel of charge on the 5,000 b/d unit described in the WPRA paper previously mentioned. Fuel value was assigned to the Platformer hydrogen in this estimate at 15 cents per million Btu.

It is planned that the Sohio Platformer will go on stream about September 1.

Both of the Lima units are licensed to Sohio by Universal Oil Products Company. Procon Incorporated is the prime contractor.

After the Sohio unit was licensed from UOP, an agreement was reached by Universal Oil Products Co. and Union Oil Co. of California under which a refiner may secure the benefit of the combined techniques and patent rights through a single license from either party. The resulting process is being offered to the industry under the name Unifining. There are now 15 units of the process with an aggregate capacity of more than 100,000 b/d planned or under construction.

Integrated Platformer-Unifiner pilot plant installation at the UOP laboratories, Des Plaines, Ill.



**Unifining*, by H. W. Grote, C. H. Watkins, H. F. Poll, and G. S. Hendricks, Western Petroleum Refiners Association, March 31, 1954.

Five hydrofining units operating

ESSO STANDARD OIL COMPANY and its affiliates have completed and placed on stream five Hydrofining units for the upgrading of various petroleum distillates by mild hydrogenation. In addition, the Esso group has planned or under construction 14 other units and has announced that Standard Oil Development will offer the process for license to other refiners.

Capacity of operating plants is rated at 28,388 b/d. Those planned and under construction will have an aggregate capacity of 126,500 b/d.

Standard's first Hydrofining unit was erected at Bayonne, N.J., to process wax. It went on stream in September 1950. The Fawley, England, plant processing lighter distillates began operations in May 1953 and the large Humble heating oil treater went on stream last September.

A wide range of refinery distillates are to be processed at Standard of New Jersey plants. Present units are charging heating oils, lubricating oils, waxes, tractor fuels and solvent naphtha. Other plants planned or under construction are designed to treat cracked and coker naphthas and gas oils and virgin naphthas, diesel fuels and gas oils.

The Hydrofining process as designed by Standard Oil Development Co. is a catalytic process employing metal oxides on alumina. As indicated in the accompanying flow diagram, charge oil enters a coil furnace, where it is heated to a temperature usually between 550°F and 800°F. It then passes to a fixed-bed reactor vessel together with the fresh hydrogen gas. In the reactor, the feed is treated in the presence of the hydrogen and a regenerable catalyst at pressures usually between 50 and 500 psi. After leaving the reactor, the product is cooled before entering a separator from which hydrogen-rich gas is recirculated back to the reactor in amounts varying according to the specific requirements of the finishing operation. After separation, the product stream enters a stripper where any residual hydrogen sulfide gas is removed. Product yield is 100 percent on the oil feed.

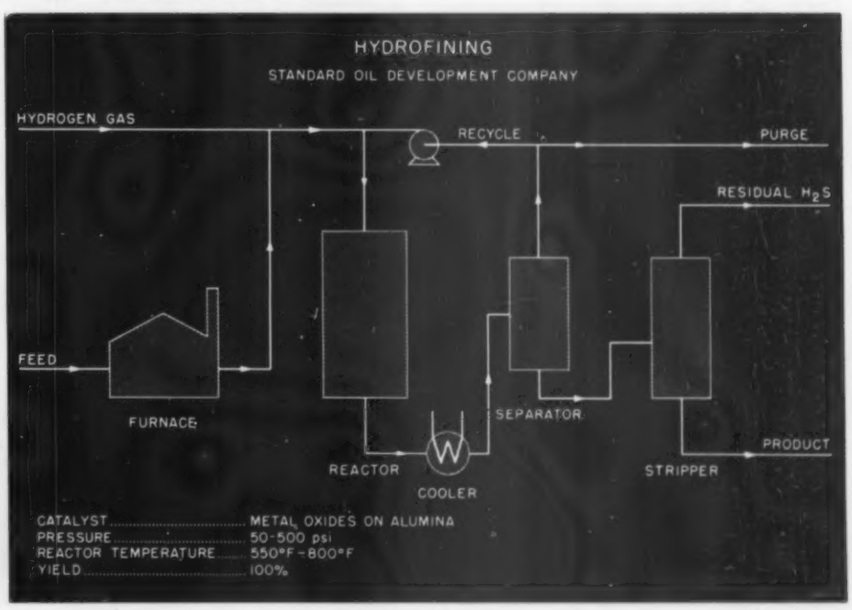
Hydrofining is designed to assist particularly in the refining of low quality crude oils, previously considered unattractive for processing. Products obtained from these crude oils can now be treated with hydrogen economically to give high quality finished materials. These low quality crudes, therefore, may be added to the available supply of petroleum suitable as raw material for gasoline, heating oil, and other needed products.

Hydrofining fits uniquely into the present refinery trend toward higher octane gasolines at refineries which are reforming low octane petroleum fractions and manufacturing large quantities of hydrogen as a byproduct. Many refineries are installing these two processes together as a modern quality improvement combination.

Products which can be upgraded by Hydrofining include waxes, turbine oils, transformer oils, premium lubricants and fuels for diesels, tractors, automobiles and home oil burners. The process is also effective in the pre-treatment of petroleum fractions for fixed bed platinum catalyst reforming units.

In the treatment of fuels, Hydrofining has shown it will successfully reduce high sulfur content, stabilize products for storage and shipping, reduce odor, prevent formation of gummy deposits and carbon residues, and generally correct those properties which might tend to foul engines and oil burners. Special conditions which provide very low cost operation have been developed for this type of treating.

In many refineries, Hydrofining will replace existing processes which involve treatment of products with strong acid, often followed by necessary re-distillation. Considerable savings will result, since acid treating unavoidably consumes some of the valuable products while the new process does not. Disposal of the



waste acid sludge ceases to be a problem.

Table I compares the treating results obtained by Hydrofining with acid treating of both heavy thermal and catalytic naphthas. Reduction in sulfur content and gum and better yields are outstanding. Similar results in the treatment of high sulfur kerosine are indicated in Table II. Color and wick characteristics are greatly improved without loss of volume.

Table III shows sulfur reduction and diesel index improvement obtained by Hydrofining West Texas and Arabian gas oils.

As a companion process, Standard Oil Development recently described its Model II Fluid Hydroformer which it is offering to the industry.

In the original Model I Fluid Hydroformer, heat is carried into the reactor in several ways: through heating the raw material by recirculating the sand-like catalyst and by compressed, heated gases. To obtain heat by these methods requires considerable equipment outside the basic refining unit, such as compressors and furnaces.

The new version of Fluid Hydroforming reduces the need for about 60 percent of the heat supplied through the external equipment and permits a 20 percent saving in costs. This is accomplished by rapid circulation of the heat-carrying particles along with the catalyst. Carbon accumulates on the catalyst during conversion of the virgin gasoline into high octane number fuel. When the carbon is burned off in another part of the unit, the inert particles become heated. Larger and heavier than the catalyst, the particles move much more speedily and continuously carry heat to the reactor.

Standard Oil Development has licensed Model I Fluid Hydroformers with a combined capacity of 127,000 barrels daily.

Announcement of the Model II method was made in a paper presented by C. W. Tyson of Standard Oil Development before the mid-year meeting of the refining division of the American Petroleum Institute.

TABLE I
Hydrofining vs. Acid Treating of Cracked Naphthas

Source	Heavy Catalytic Naphtha			Heavy Thermal Naphtha		
Boiling Range	250/442°FEP			300/450°FEP		
	Feed	Hydro-fining	Acid* Treat-ing	Feed	Hydro-fining	Acid Treat-ing
Sulfur, Wt.%	0.24	0.07	0.21	0.28	0.12	0.17
Bromine No.	23	17	19	34	24	31
General Motor Gum 2# UOP5	3	0.5/2.4	3	12	0.5/1.0	2
ASTM Breakdown-Min.	465	1440+	790	70	1440	250
CFR-Res. Octane Clear	92.5	90.5	91.5	59.5	52.5	59.5
with 2 cc TEL/gal.	96	95.5	95.0	70	69	70
Yield—Vol. %	—	100	98	—	100	97

Purpose of Operation: stability improvement; desulfurization secondary.
Hydrofining provides better improvements in gum and breakdown with higher yields and no greater loss in octane. Hydrofining of thermal reformates provides similar improvements in gum, breakdown and also with no yield or octane loss.
* 4#/B—76% Acid.

TABLE II
Hydrofining To Make Kerosine

Source	Low Sulfur Feed		West Texas Feed	
Boiling Range	338/550°FEP		312/515°FEP	
	Feed	Product	Feed	Product
Sulfur, Wt.%	0.10	0.04	0.55	0.10
Wick Char	30	18	65	23
Smoke Point	22	23	20	20
Color, Saybolt (Color Hold)	+20 (+17)	+26 (+26)	+3	+23 (+21)
Copper No.	—	<1	68	<1
Doctor Test	—	Pass	—	Pass
Odor	—	Good	—	Good
Yield—Vol. %	—	100	—	100

Purpose of Operation: Preparation of good kerosine from sour, sulfur stocks.

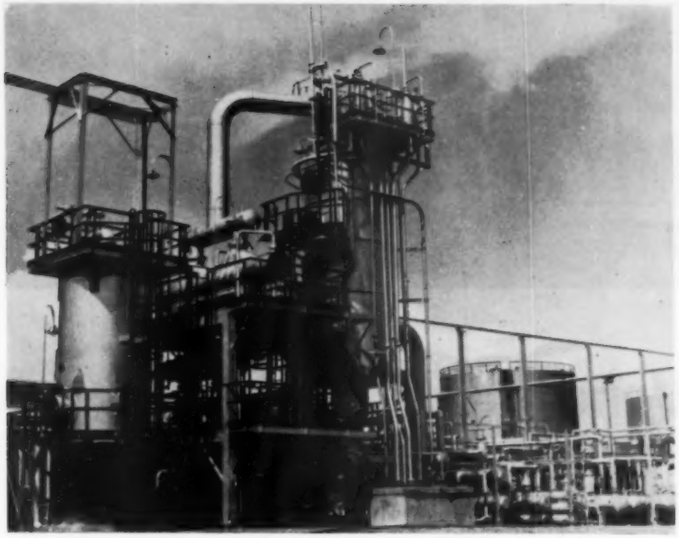
TABLE III
Hydrofining of Light Virgin Gas Oil (Diesel)

Source	West Texas		Arabian*	
Boiling Range	308/641°FEP		495/682°FEP	
	Feed	Product	Feed	Product
Sulfur, Wt.%	0.92	0.2-0.5	1.6	0.40
Copper No. mgS/100 ml.	92	0.2-1.0	—	—
Gravity °API	37.9	38.5	29.8	32.2
Color, Tag Rob. (aged)	—	18	—	18(17)
Carbon Residue 10%	—	0.04	0.06	0.06
Aniline Point	143	146	151	153
Diesel Index	54	56	45	49
Cetane No.	—	—	51	52
Bromine No.	—	—	10	4
Yield, Vol. %	—	100	—	100

Operation on straight cracked stocks is also feasible and provides substantial increase in diesel index, reduction in sulfur, etc.
*Contains 17% 430/650°FVT catalytic cycle stock from Iraq gas oil.

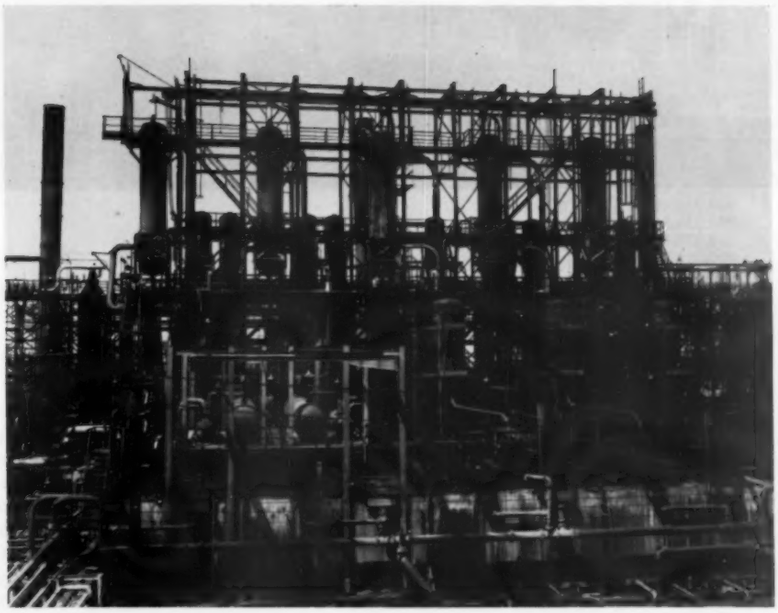
TABLE IV
Hydrofining Plants, Affiliates of Standard Oil (New Jersey)

Company	Refinery Location	Status	Type Feed	Design Feed Rate B/SD
Esso Standard Oil Co.	Bayonne, New Jersey	Operating	Wax	2,500
" " " "	Linden, New Jersey	Under construction	Heavy thermal naphtha	7,640
" " " "	Linden, New Jersey	Under construction	Cracked heating oil	19,520
" " " "	Baton Rouge, La.	Planned	Virgin gas oil	26,200
" " " "	Baton Rouge, La.	Planned	Coker gas oil and naphtha	12,740
" " " "	Baltimore, Maryland	Under construction	Lt. virgin, lt. coker and heavy cracked naphtha	12,000
" " " "	Baltimore, Maryland	Under construction	Heavy virgin naphtha	3,000
" " " "	Baltimore, Maryland	Under construction	Heavy cracked heating oil	5,000
" " " "	Everett, Mass.	Planned	Heavy cracked naphtha	2,400
" " " "	Everett, Mass.	Planned	Heavy cracked heating oil, coker heating oil	2,250
Humble Oil & Ref. Co.	Baytown, Texas	Operating	Heating oil	20,000
" " " "	Baytown, Texas	Planned	Lubes	4,850
" " " "	Baytown, Texas	Planned	Heavy cracked naphtha	12,000
Imperial Oil Ltd.	Sarnia, Canada	Operating	Lubes and waxes	600
" " "	Edmonton, Canada	Under construction	Lubes	2,000
Esso Petroleum Ltd.	Fawley, England	Operating	Tractor fuel	3,705
" " "	Fawley, England	Operating	Solvent naphtha	1,583
Esso A.G.	Hamburg, Germany	Planned	Diesel gas oil	8,450
Esso Standard, S.A.F.	Port Jerome, France	Planned	Virgin gas oil	8,450

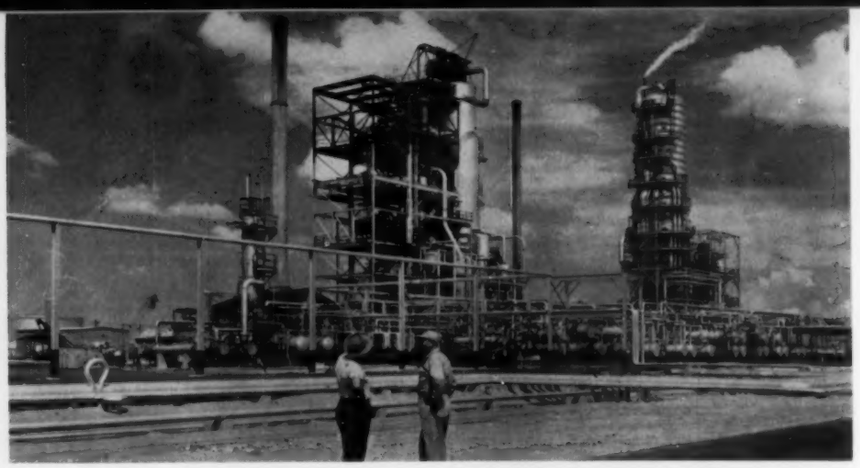


Left: On stream since fall of 1953, this Hydrofining unit at the Fawley, England refinery of Esso Petroleum Company Ltd. is used to upgrade 1,580 barrels per day of solvent naphtha.

Right: Hydrofining units nearing completion at Bayway refinery of Esso Standard Oil Co. With combined capacity of over 27,000 b/d, these units will process heavy thermal naphtha and cracked heating oil for stability improvement.

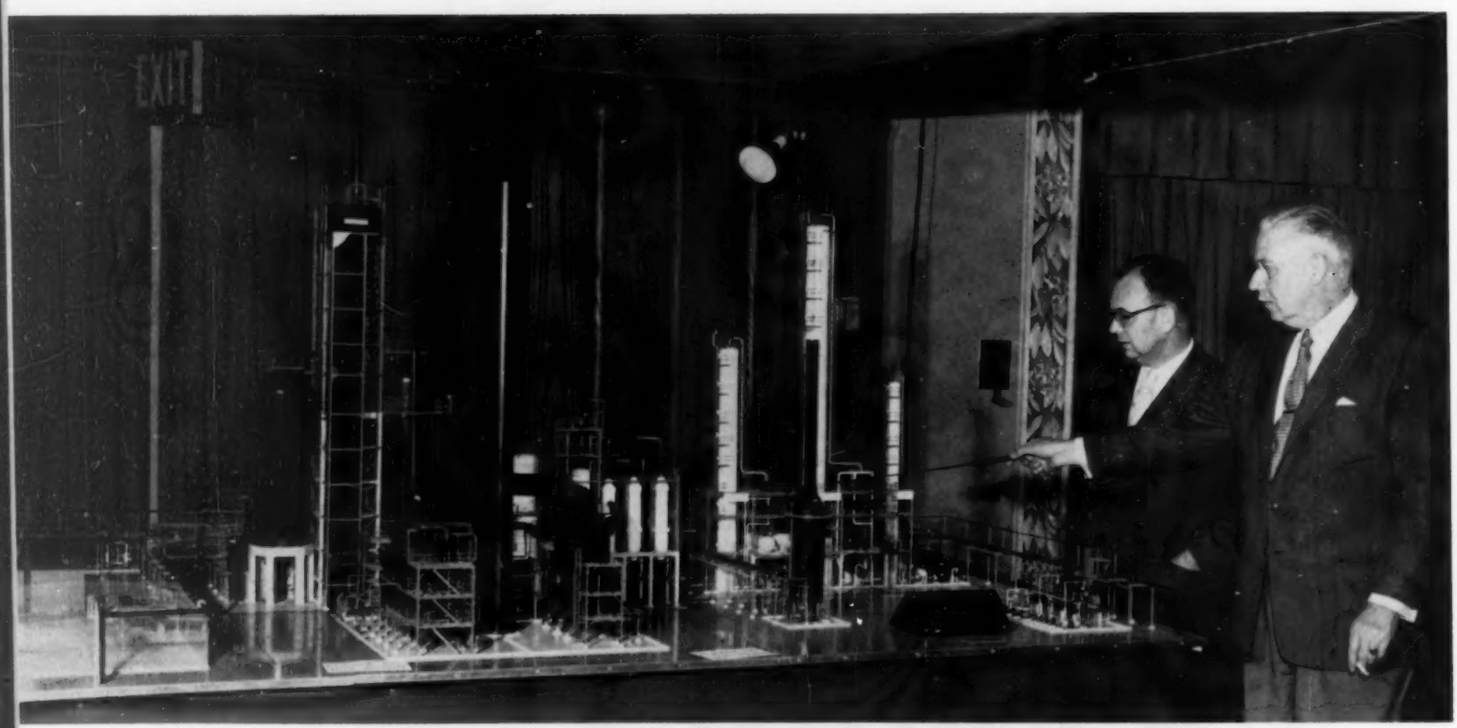


Hydrofiner at Humble's Baytown, Texas, refinery is processing over 20,000 b/d of heating oils. Two additional units are planned for this refinery for improvement of lubes and heavy cracked naphthas. A former thermal cracking unit was converted to Hydrofining service.



Amuay Bay refinery on Paraguana peninsula, northwestern Venezuela. Photo courtesy Creole Petroleum Corp.

Refining operations in Venezuela show 346 percent rise in five years



C. H. Cole, assistant manager of the refining department, Creole Petroleum Corp., Caracas, is shown a scale model of Creole's proposed new fluid hydroformer by Eric W. Luster, right, vice-president in charge of engineering for Standard Oil Development Co. The hydroformer will be completed at the Amuay Bay refinery in 1955.

ONE OF THE MOST MARKED phenomena of worldwide postwar petroleum activity has been the expansion of refinery capacity. In this field, Venezuela has been among the leaders.

In 1953, almost 3.5 times as much crude oil was refined in Venezuela as in 1948. For the whole of last year, runs to stills averaged 413,240 b/d. Additional capacity was being added throughout the year and runs in the month of December averaged 446,100 b/d.

Sometime in 1955, the half-million b/d mark probably will be passed, at which time Venezuela will be refining about one-quarter of its production, and shipping out about 95 percent of the derivatives.

While some sectors of the Venezuelan business world are in favor of refining a still higher percentage of indigenous production, the Minister of Mines & Hydrocarbons has pointed out that refinery expansion has been proceeding apace in other countries, too, with the strategic purpose of increasing self-sufficiency and the economic aim of saving exchange by buying crude rather than products.

This naturally tends to circumscribe the markets open to Venezuelan oil.

In the oil business, it is hard to make a prediction stick, and no one has recently ventured to declare that Venezuelan refining expansion has reached its economic limits. In 1952, an independent consultant said in print that 400,000 b/d was probably the maximum. Major additions currently under way will boost capacity to just over 500,000 b/d in 1955.

No big projects are scheduled to follow those now in progress, so perhaps there will be a moratorium on refinery construction when the half-million mark is reached. On the other hand, the world market has been elastic enough so far to accommodate Venezuela's whole output of derivatives. When the industry sees other potential markets ahead, more refinery capacity will be built.

The first oil refinery in the country was built by Shell in 1918 at San Lorenzo, on the eastern shore of Lake Maracaibo, to process crude from the Mene Grande field.

As of 1939, Venezuela's capacity was only 50,000 b/d, and in 1949 the total processed had still not reached 150,000. However, the Hydrocarbons Law was

TABLE V
Products Derived in Venezuelan Refineries, 1953

Product	Barrels	Approx. Percent
Fuel oil	85,844,000	56.5
Diesel oil	23,084,000	15.5
Gasoline & naptha	22,469,000	15.0
Gas-oil	6,037,000	4.0
Kerosine	4,686,000	3.0
Lubricants	1,143,000	1.0
Asphalt	876,000	0.5
Others*	7,495,000	5.0
Losses	699,000	—0.5
	150,935,000	100.0

*Includes jet aviation fuel, liquid propane gas, turbine fuel and minor quantities of a great variety of sub-products, including spot-remover, insecticides and weed killers.

TABLE I
Refinery Growth in Venezuela

Year	Total Bbls. Refined	Bbls./Day	Bbls. Gain	Percent Gain Yearly	Percent Gain over 1948
1948	43,852,000	119,100		base year	
1949	53,151,000	145,600	39,569,000	21.9	122
1950	91,325,000	250,800	38,174,000	71.8	210
1951	115,271,000	315,800	19,446,000	26.2	265
1952	127,204,000	348,500	11,933,000	10.4	292
1953	150,935,000	413,240	23,731,000	18.6	346

TABLE II
Percentage of Production Refined in Venezuela

Year	Barrels Produced	Barrels Refined	Percent Refined
1948	490,770,000	43,582,000	8.8
1949	483,210,000	53,151,000	11.0
1950	547,470,000	91,325,000	16.6
1951	623,070,000	115,271,000	18.5
1952	660,490,000	127,204,000	19.2
1953	644,586,000	150,935,000	23.4

TABLE III
Production Growth (compare Table I)

Year	Barrels Produced	Change, in Barrels	Percent Change Yearly	Percent Change Over 1948
1948	490,770,000		base year, 100	
1949	483,210,000	—7,560,000	—3.5	96.5
1950	547,470,000	56,700,000	13.3	111.5
1951	623,070,000	132,300,000	13.8	126.9
1952	660,490,000	169,720,000	7.0	134.6
1953	644,586,000	—15,904,000	—2.4	131.3

TABLE IV
December Throughout and Major Plants

Company	Location	Bbls., Dec.	Approximate Barrels/Daily	Percent of Total
Shell	Cardon (WV)	5,051,189	163,000[1]	36.6
	San Lorenzo (WV)	1,423,384	46,000	10.3
Creole Pet.	Amuay (WV)	2,592,945	81,000[2]	18.1
	Caripito (EV)	2,068,252	67,000	15.0
Ven. Gulf Ref.[3]	Puerto la Cruz (EV)	1,831,202	60,000	13.3
Sinclair	Puerto la Cruz (EV)	623,215	20,000	4.6
Texas	Tucupita (EV)	209,670	7,000	1.5
Subtotals		13,708,957	443,000	99.4
Others	EV & WV	86,840	3,000	0.6
Totals		13,795,797	445,000	100.0

[1]—7,000 b/d being added.
[2]—64,000 b/d being added.
[3]—Owned by Gulf and Texas.

TABLE VI
Crude & Products Exports Compared

Year	Total Exports	Barrels Exported Crude	Barrels Exported Refined	Approx. Percent Crude	Percent Refined
1949	460,013,000	422,828,000	37,185,000	92	8
1950	526,318,000	452,348,000	73,970,000	86	14
1951	589,728,000	502,646,000	87,082,000	85	15
1952	626,798,000	531,904,000	94,884,000	85	15
1953	607,466,000	489,657,000	117,809,000	81	19

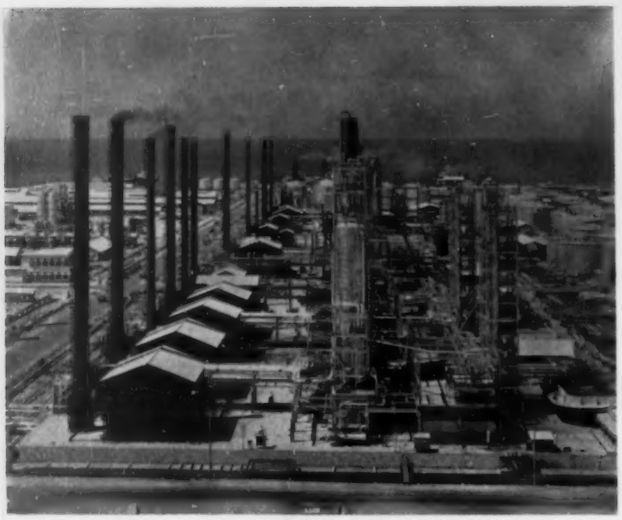
TABLE VII
Production and Exports Compared

Year	Production	Total Exports, Crude and Refined	Percent Exported
1948	490,770,000	470,320,000	95.8
1949	483,210,000	460,013,000	95.2
1950	547,470,000	526,318,000	96.1
1951	623,070,000	589,728,000	94.7
1952	660,490,000	626,798,000	95.0
1953	644,586,000	607,466,000	94.1

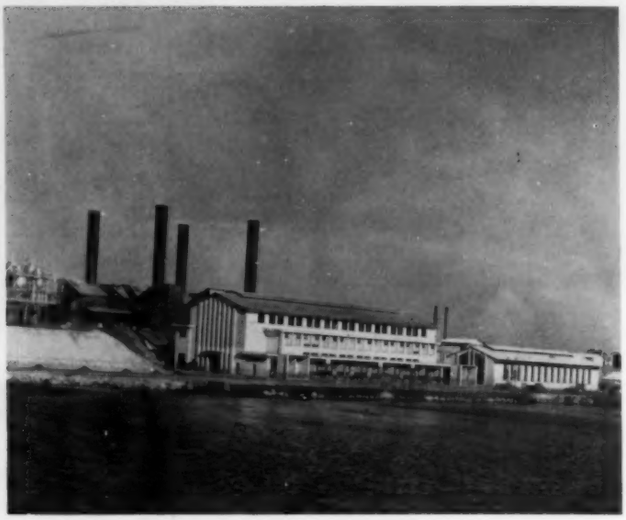
TABLE VIII
Major World Markets for Venezuelan Exports

	Percent of Crude Exports			Percent of Refined Exports		
	1953	1952	1951	1953	1952	1951
Aruba-Curacao[1]	51.71	55.28	59.24	15.12	14.14	15.53
United States	24.49	23.18	21.43	33.22	30.52	28.76
Canada	11.68	9.61	8.98	2.65	2.80	3.53
Europe	5.00	5.05	4.34	15.97	20.20	25.20
South America	3.61	3.05	2.27	21.04	23.23	19.21
Africa	...	...	...	3.76	2.86	2.47
Brit. West Indies	3.04	2.93	2.84	2.12	3.38	3.65
Others	0.47	0.90	0.90	6.12	2.87	1.65
	100.	100.	100.	100.	100.	100.

[1]—Refinery sites.



Distillation and lube sections of Shell Company of Venezuela's Cardon refinery.



Power plant at Shell's Cardon refinery.

overhauled in 1943, and one of its new provisions embodied a refining obligation. Nothing could be done about this in the war years, but a tremendous amount of catching up has taken place subsequently.

The largest yearly refining increase was experienced in 1950. That year, both Creole Petroleum and Shell interests had big new plants on stream, both on the Paraguana Peninsula of Western Venezuela. Venezuela Gulf Refining (Gulf Oil Corp. and Texas Petroleum) and Sinclair have erected large-scale plants in Eastern Venezuela since that time, and other operators have made lesser installations on both sides of the country.

Table I shows how refining in Venezuela has more than tripled in the last six years.

Production in the meantime has not been standing still. In 1952-53 it was one-third higher than it had been in 1948. The growth in refining operations, however, has so far outstripped the rise in production that, from 8.8 percent of total production in 1948, the industry refined 23.4 percent of the greatly increased production of 1953. Tables II and III demonstrate this in detail.

While there are in Venezuela about 20 plants in which refining operations are carried on, less than half of these contribute refined products to the internal or external market. The others have capacities ranging from 100 to 1,000 b/d and their output of motor fuels or road surfacings is consumed in company operations.

Five companies, operating seven plants, accounted for 99.4 percent of refinery throughput in December 1953, as shown in Table IV.

Among the smaller refineries, the 2,000 b/d Phillips plant at San Roque field, Anzoategui, is unique. Besides manufacture of gasoline, kerosine and diesel fuel, the plant was specially designed to turn out some 200 tons per month of paraffin. The waxy crudes that form the bulk of the company's production are well suited to this purpose. The product, now used mainly for the making of church candles, will in time make Venezuela self-sufficient with respect to wax, instead of having to import it, as formerly.

As Table IV shows, the biggest refinery by far in Venezuela to date is Shell's Punta Cardon installation with its 163,000 b/d throughput in December. When it went on stream in 1949, two years after ground was broken, this plant was designed for a capacity of 60,000 b/d. Additions have been made almost continuously since that time. The largest recent additions have been a complete lubricating-oil plant and a second distillation unit. Full effect of the expansion program will not be felt until sometime this year, when it is expected that Cardon will be processing 170,000 b/d.

Creole Petroleum Corporation's refinery at Amuay Bay, a next-door neighbor to Shell's plant on the Paraguana Peninsula, also went on stream in 1949 with a design capacity of 60,000 b/d. Expansion there also has been continuous, and the program will not be complete until 1955. At that time, Amuay will be handling 145,000 b/d.

Additions include a new 70,000 b/d pipe still which will be completed late this year, and a 10,000 b/d hydroformer (world's largest) scheduled for completion early in 1955. A total of $7,079,000 was spent on this work in 1953, not including the cost of a 143-mile, 26-inch pipe line laid to the refinery from the Bolivar Coastal fields of Lake Maracaibo. This line parallels the original 20-26-inch line laid to Amuay Bay in 1948. Total combined capacity of the two lines is 520,000 b/d. The portion not processed in the refinery is exported as crude from the deepwater terminal adjoining the plant.

Recent additions to other plants include a gasoline-stabilization unit at Sinclair's Puerto la Cruz refinery. At Venezuela Gulf's plant at Puerto la Cruz, new units include a 7 by 35-foot tower for the making of kerosine, marine diesel oil and heavy gas oil.

There is almost twice as much refinery capacity in Western Venezuela as in Eastern Venezuela, roughly 300,000 b/d to 150,000 b/d. Western Venezuelan crudes, which constitute about 70 percent of Venezuela's production, are in general of heavy quality, while those of Eastern Venezuela are light.

Naturally enough in these circumstances, residual fuel oil, the least valuable product of the distillation of crude, is the principal product of Venezuela. However, additions to cracking facilities have decreased the fuel oil yield from about 60 percent two years ago (and 70 percent six years ago) to 56.5 percent in 1953. At the same time, the yield of gasoline and naphtha has increased from 10 percent to 15 percent. (In the United States, this situation is reversed. The average yield of gasoline per barrel of U.S. crude has been about 43 percent, while the yield of residual fuel oil has been about 19 percent. This is the point of Venezuela's argument that her exports to the United States supplement, but do not supplant, U.S. domestic crudes.)

It probably will be many years before internal consumption, including that of the companies themselves and of the

commercial market, accounts for as much as 10 percent of Venezuela's production. However, of recent years, internal consumption has been making inroads on the amount of oil available for export. Table VI shows that 95.8 percent of the crude produced was exported in 1948, 94.1 percent in 1953.

The increase in the relative amounts of refined products has been very pronounced, from eight percent in 1949 to 19 percent in 1953, in line with the growth of refineries. Table VII compares the proportions of crude and derivatives shipped out of Venezuela 1949-1953.

Venezuela's growing emphasis on refining has given rise to many shifts in its markets for both crude and refined products in the past few years. The growth of refining capacity in other countries is also reflected in Table VIII. In the case of Britain, for example, the growth of indigenous capacity has caused a reduction of some size in the amount of Venezuelan derivatives imported. Where England took 11.56 percent of Venezuela's total refined products in 1951, in 1953 she took only 3.92 percent.

Only 13 European countries including England were importing Venezuelan refined products in 1951. By 1953, the number of European customers had risen to 32. However, most of them took less than one percent of the total. The net loss in European markets, including England, was almost 10 percent from 1951 to 1953, and that had to be compensated for elsewhere.

Brazil is the best South American customer for Venezuelan refined products, taking 18.70 percent of the total exported in 1953. Argentina takes more Venezuelan crude than any other South American country. In 1953 crude shipped to Argentina was 2.35 percent of total production.

Of the 43 countries taking Venezuelan refined products in 1953 (compared with 36 in 1951), Malaya was the next best market after Africa, with 2.25 percent against Africa's 3.76.

Canada's augmented receipts of crude, 11.68 percent in 1953 as against 8.98 percent in 1951, were offset by a drop in its take of derivatives, from 3.53 percent of Venezuela's total in 1951 to 2.65 percent in 1953.

Finland and Denmark, customers for refined products in 1951, had both dropped out of the running by 1953.

Aruba and Curacao are taking substantially lower quantities of Venezuelan crude. While 59.24 percent of total crude exports went to these islands in 1951 for processing at the Standard Oil and Shell refineries there, by 1953 they were taking 7.5 percent less.

In the same period, United States receipts of Venezuelan crude went from 21.43 percent to 24.49 percent. The U.S. also took more derivatives, from 28.76 percent of the total exported in 1951 to 33.22 percent in 1953.

Domestic consumption of Venezuela's refinery product is markedly on the increase. In 1948 the local market used 8,379,822 barrels of white and ethyl gasoline, avgas, white spirit, fuel oil, asphalt and other products. In 1952 (figures for 1953 not available), the volume of similar products consumed rose to 20,977,702 barrels, for a net gain of 150 percent. This amounted to 13 percent of total refinery products in that year.

Venezuela is tied with Australia for fourth place as a consumer of petroleum derivatives. Some other standings in 1952 are shown in Table IX (Ministry figures).

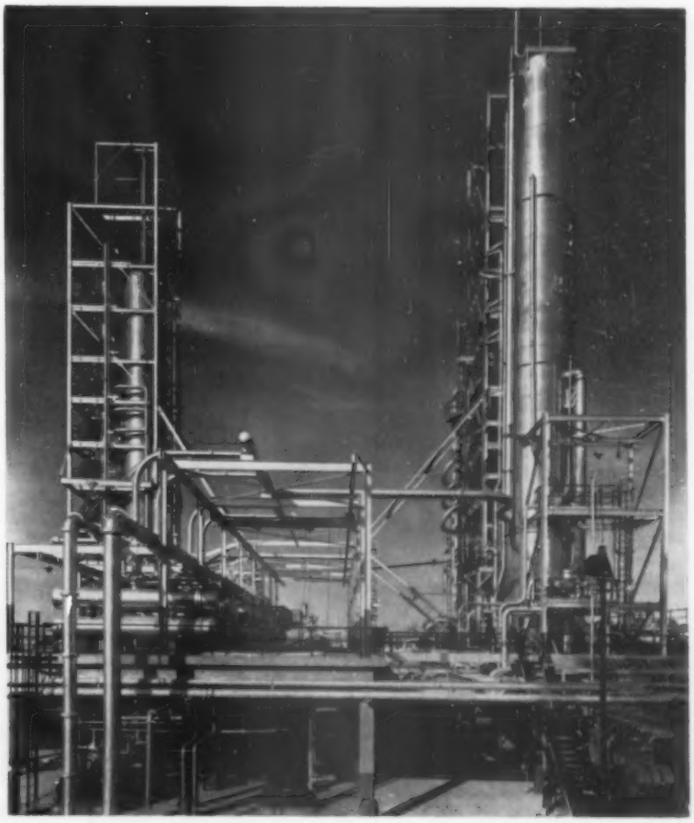
Venezuela is about in fifth place with respect to the number of automobiles in proportion to population. Several factors contribute to this, including the general high level of prosperity and the almost total lack of railroads. A contributing factor may be the price of 12 cents per gallon for 78-octane Ethyl gasoline. As Table X shows (Ministry 1952 figures), this is probably a world low. Shell and Creole, the only companies supplying the domestic demand for motor gasoline, have long complained of losing money on this grade. The price has not been changed, but both are now supplying a "premium" grade of high-octane gasoline at double the price of the "regular."

TABLE IX
World Consumers of Petroleum Derivatives

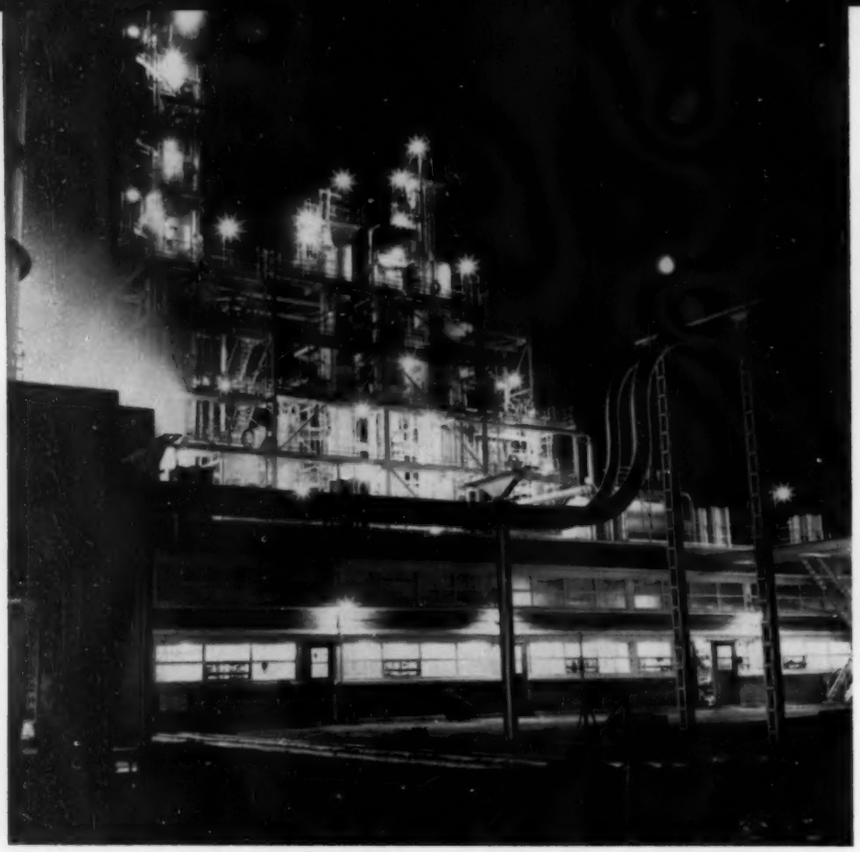
Country	Rank	Bbls./Capita
United States	1	16.8
Canada	2	10.4
Sweden	3	4.8
Venezuela	4	4.5
Australia	4	4.5
United Kingdom	10	3.0
Mexico	12	2.6
Peru	17	1.2
Colombia	18	0.9

TABLE X
World Prices of Gasoline

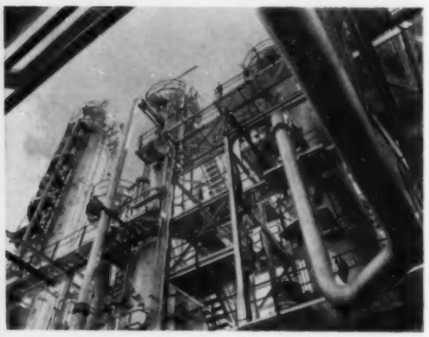
Place	Price/liter
Venezuela ...	Bs. 0.10 (about 12c/gal.)
Bogota	0.1726
Buenos Aires ...	0.2381
United States ..	0.2395 (avg. of 50 cities)
Rio de Janeiro .	0.3186
London	0.3646
Paris	0.5080
Rome	0.6859



Largest high vacuum distillation unit outside the United States is at Shell's Cardon refinery.



MEK unit at the Gonfreville plant of Compagnie Francaise de Raffinage.



Furfural extraction unit at Dunkirk refinery of Societe Generale des Huiles de Petrole B.P.

French refinery industry expands

By Bernard Pene

DURING THE PAST YEAR the capacity of French refineries has markedly increased. The tonnage treated in 1953 was 166,455,250 barrels against 157,973,600 in 1952.

However, the increase was only five percent, which is less than it was in previous years. It corresponds strictly to the increased needs of France and its overseas territories; the volume of exports and equivalent operations remained substantially the same.

The products refined by the French refineries had the following destinations:

France & French Bunkers	65.9 percent
N. Africa & Overseas Territories	11.0 percent
Custom work, exports, etc.	23.1 percent

Of the 166,500,000 barrels of crude oil treated in 1953, 3,131,100 barrels came from national sources, compared with 3,557,400 barrels from the same sources in 1952. This tonnage represents a small part of French needs (2.7 percent) and it is considered certain that this percentage will increase notably in the coming years.

Overlooking for the moment the encouraging indications which have been turned up in various parts of the French Union, particular reference may be made to the Parentis deposit (situated near the Landes coast between Bordeaux and Bayonne) recently discovered by Esso Standard within the limits of its concession. It is now known that the crude oil from this deposit is of excellent quality with a high content of gasoline and a low content of sulfur. It is still too early to make a pronouncement on the importance of this deposit, but it is not doubted that its discovery is one of the most encouraging results of exploration conducted on French soil. It is expected that during 1954 (and especially in 1956) the Parentis deposit will have a significant part in supplying France with oil.

From January 1 to December 31, 1953, crude imports were 163,177,353 barrels, nearly all of which came from the Middle East. The tonnage furnished by the French oil companies as their part of Iraq production was 32.8 percent of the oil imported for French needs; this is a sharp increase over 1952, when this proportion was 24.4 percent. On the other hand, the "agreements on payment" that have been in effect for three years have allowed

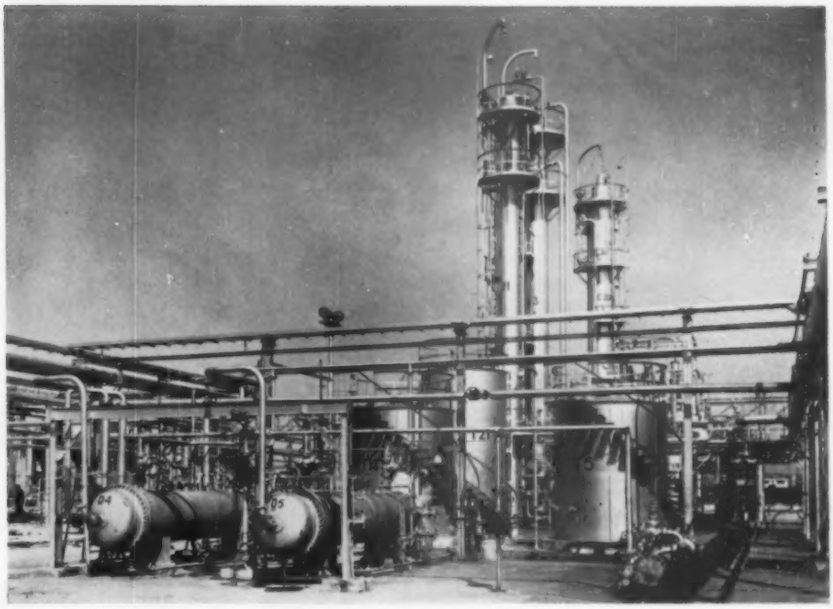
such payments, in proportions up to 40 percent, for the Middle East crudes furnished by the American companies.

The following table shows the different percentages and the funds used in payment:

	PERCENT
National Crude	2.7
C.F.P. Crude	32.8
Middle East Crude (paid in francs according to agreement)	9.0
Crude from dollar sources	18.2
Crude from pound sterling sources	37.3

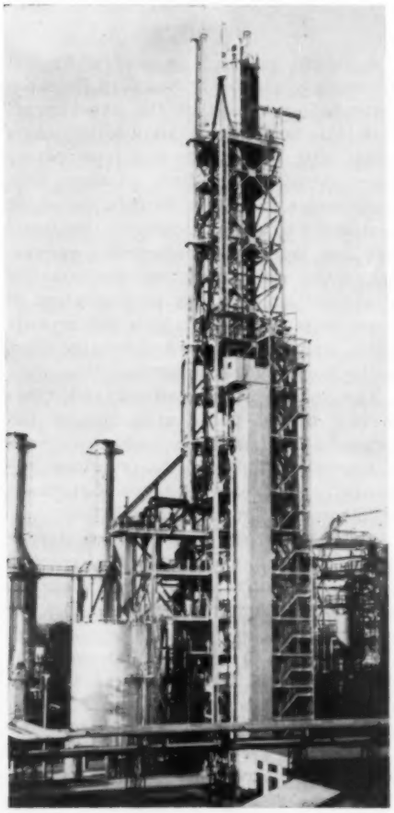
The expense in pounds and dollars occasioned by purchase of crude oil have been in large part compensated by foreign exchange derived from imports, custom work or equivalent operations. These operations involved 52,352,800 barrels of finished products, of which 16,891,200 were for North Africa and the overseas territories.

As regards 1954, mention may be made of new supplies in the form of a small tonnage of Russian oil (150,000 tons) imported by the Raffineries Francaises de Petrole Atlantique within the frame of a trade agreement, and treated at the Raffinerie Pechelbronn-Merkerwiller.



Girbotol unit at Shell Berre refinery.

TCC unit at the Donges plant of Raffineries de Petrole de l'Atlantique.



The proportion of the tonnage transported by French ships in 1953 was 56 percent of the total against 54 percent in 1952. This small increase was the result of an increase of the French petroleum fleet (which has risen from 1,191,000 tons to 1,283,000 tons) and in particular of the constantly growing amount of Middle East crude from the terminals of the pipe lines.

The decrease in imports of finished products in 1953 (3,506,000 tons against 5,336,100 in 1952) has particularly affected the 100/130 octane aviation gasolines (low sulfur oils).

Consumption showed an overall increase over 1952 of 8.6 percent. This increase affected all products, except lubricants, with marked preponderance of premium gasoline, gas-oil, liquid fuels and liquefied gas. Ordinary gasoline consumption increased only 3.25, while premium gasoline showed an increase of 38 percent.

Domestic consumption of heavy fuels progressed 8.7 percent, whereas the consumption of gas oil rose 15.4 percent and that of liquid fuels 14.4 percent. On the other hand, the bunker market suffered a reduction of 7.3 percent. Consumption of lubricants, which fell off in 1952, has again decreased by four percent. On the other side, there has been an important extension in the use of liquefied gas, of which consumption in 1953 was 24 percent over that of 1952.

Due to the installation, the quality of gasoline has been improved. As of September 1, 1953, the octane number of premium gasoline had been raised to 87 (research method) and on the 1st of March, 1954, the octane number of ordinary gasoline passed from 70 (motor method) to 75 (research method).

As France is abundantly supplied with refining capacity, no major construction projects have been started this year. Most of the activity has been in the completion and starting-up of new catalytic cracking units that were begun a year or two ago. At the Port Jerome refineries (La Mede and Berre), cracking units were put on stream during the current season. Cracking units at the Donges refinery and at the cumene plant were completed at the end of the year. At Berre, the sulfur recovery unit has been put in service and a new boiler plant and various buildings have been completed. Raffinerie de L'Avera has installed a Platforming unit along with other changes in equipment. An atmospheric distillation unit at Pechelbronn will increase capacity to 4,200 b/d. A general movement has been under way to increase storage capacity at most of the refineries.

Dr. Matthew H. Hohn, of the Philadelphia Academy of Natural Sciences, is about to place a Catherwood Diatometer in the Sabine River, Texas, during a recent survey of the stream.

Current developments in refinery waste disposal

By William W. Hassler

AFTER HAVING ENJOYED years of quiet, unpublicized progress in the development of refinery waste disposal methods, the oil industry has suddenly found itself in the spotlight as a principal defendant in a pollution problem about which little is actually known — smog. This atmospheric condition, which describes a mass of foul air varying in color from blue to dark gray, is particularly acute in Los Angeles, where it produces eye irritation, throat burning and headaches in addition to damaging crops and cracking rubber.

Although the air pollutants in the Los Angeles area include those from many industrial plants, two million cars, a million home incinerators and backyard burning pits, and orchard heaters—an unverified theory that smog results from the reaction of ozone with unsaturated hydrocarbons arising from the evaporation of cracked gasoline has by-passed these contributing factors to point an accusing finger at the refineries.

A chorus of public indignation against the oil industry has prompted legislative proposals varying from a resolution that Los Angeles Basin refineries revert to pre-World War II refining methods, to a regulation that would require refineries to shut down during smog periods. However, P. S. Magruder, new chairman of the Smoke and Fumes Committee of the Western Oil Gas Association, claims that of the million tons of polluted air daily estimated to be in the Los Angeles Basin atmosphere, only 315 tons of gaseous hydrocarbons are emitted by the oil industry. It is contemplated that this figure will be reduced 100 tons by the installation of vapor conservation devices. Moreover, the volume of hydrocarbons contributed by the exhaust from motor vehicles is estimated at 800-1000 tons daily, or about three times the amount from refineries.

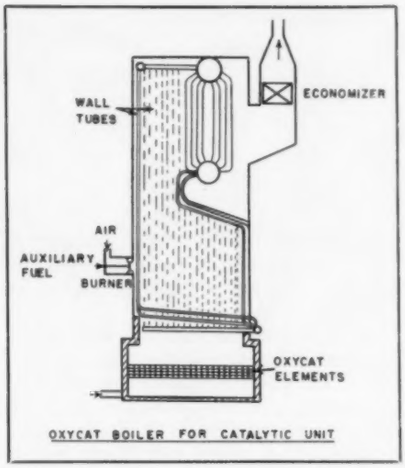
Oil industry spokesmen further contend that the role of hydrocarbon pollution has been over-emphasized. Much light will be cast on this point by the ten projects now in progress under the auspices of the Smoke & Fumes Committee of the Division of Refining of the American Petroleum Institute. These investigations, assigned to seven different institutions, range from the development of methods to determine the total organic matter in polluted atmosphere to studies of the reactions between hydrocarbons and gases such as ozone and nitrogen dioxide.

A recent progress report on Project 6.1 being conducted at Stanford Research Institute discloses that the experiments to date do not demonstrate whether ozone reacts with olefins escaping from petroleum industry operations to form products which are either harmful or which contribute to smog. However, the Institute has found that automotive exhaust gas mixed with an appropriate quantity of air containing a low concentration of ozone forms products which reduce visibility, irritate the eyes, and damage crops in the same manner as smog.

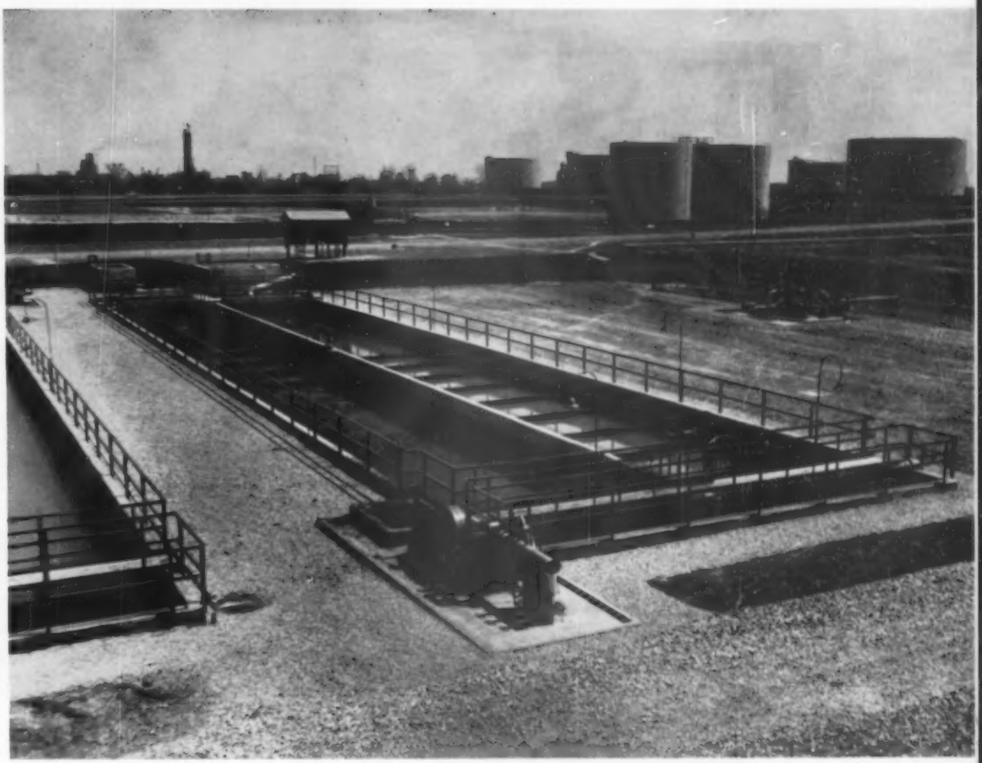
The increasing magnitude and complexity of air pollution problems has focused attention on the various methods of control available to the petroleum industry. Some of the more significant developments are described below:

1. Control of evaporation from storage tanks containing gasoline and cracked stocks. In contrast to the conventional fixed roof design from which vapors are gradually displaced to the atmosphere, a newer type floating roof moves up or down on the liquid surface, thereby minimizing evaporation losses. The trend toward floating roofs is evident in the Los Angeles area where 100 tanks are being fitted with this design.

At some refineries storage tanks are

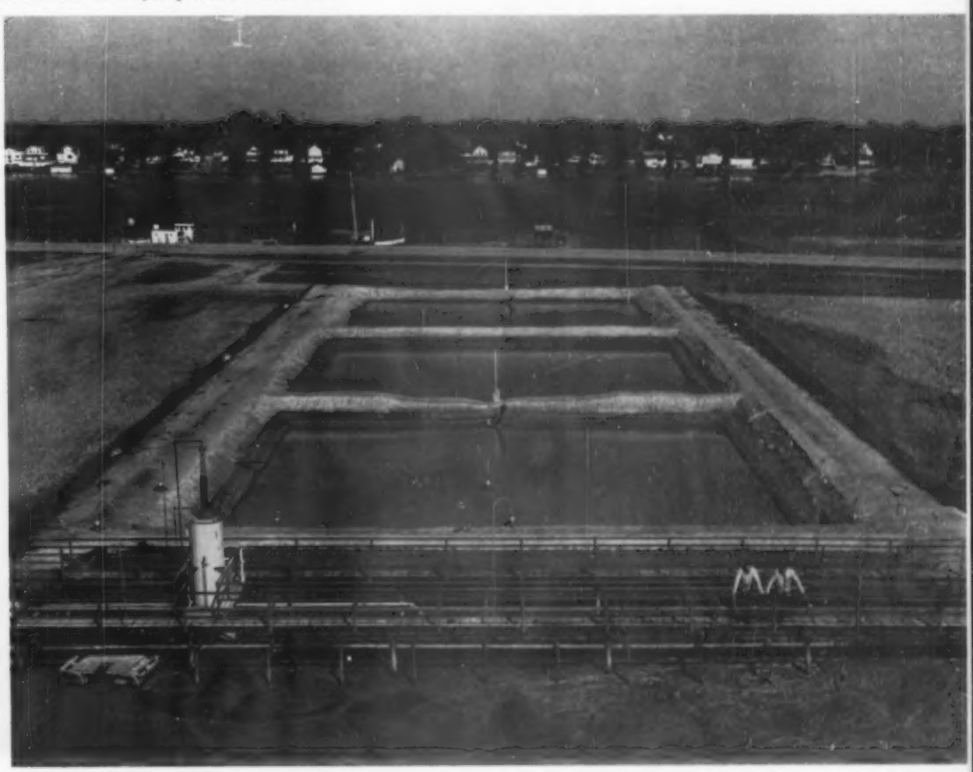


Oxycat boiler for catalytic cracking unit. In this waste-heat recovery unit, flue gas enters a combustion chamber built in the lower part of a two-drum boiler. After passage through the catalyst (supported by a refractory checker work), the hot gases transfer most of their heat to the boiler, and finally are exhausted through an economizer.



Waste water disposal facilities at the Sun Oil Co. refinery, Sarnia, Ontario, Canada. Shown at far left is the cooling water separator; at the left center is the contaminated storm water separator; the biological sludge separator is shown at the right center; the process waste water separator appears in the upper right; and the biological aeration basin is shown in the background, upper center.

A close-up view of the biological oxidation basin using the activated sludge principle at Sun's Sarnia refinery. The process separator effluent is treated here for phenol removal.



being tied into the existing vapor recovery systems, while still others incinerate vapors to prevent their escape into the atmosphere.

2. Sulfur recovery. An estimated 80 percent of all sulfur dioxide formerly discharged to the air by Los Angeles refineries has been eliminated by the installation of sulfur recovery units. The removal of sulfur dioxide from waste gases may be accomplished by collection of the gases followed by scrubbing with water or dilute alkaline solutions. Of interest is the fact that smog has become worse despite this sharp decrease in sulfur dioxide emission.

In connection with the sulfur dioxide problem, a new simple and rapid method of determining the sulfur dioxide and sulfur trioxide content in the combustion gases of an operating boiler has been reported by the Babcock & Wilcox Company. With relatively simple equipment, the method requires only a small table, standard laboratory glassware, and a source of distilled water. The time required for such analyses has been reduced from one day to one hour, thereby making it possible to collect samples during one test and obtain the results before a subsequent test on the same day. In

(Continued on page 107)

U.S. refiners continue to build surplus capacity

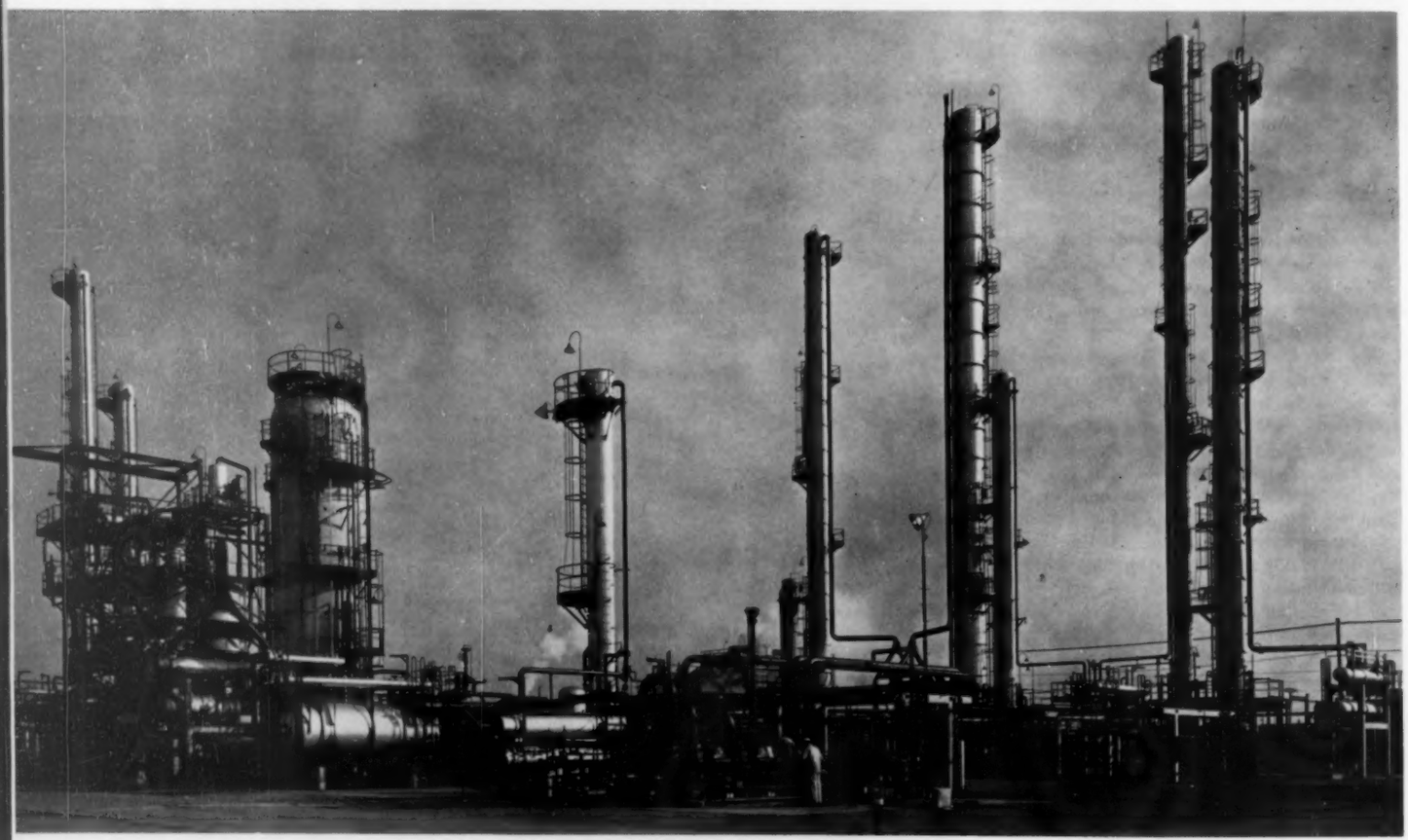
REFINERY COMPLETIONS and enlargements coming into operation in the United States during 1954 are realizing the goal set by the Petroleum Administration for Defense following the outbreak of the Korean war of providing surplus capacity sufficient to meet any emergency likely to arise. During the three years 1951-53, refining facilities were expanded by nearly a million barrels daily. The target set for the end of 1954 in the tentative time table was a total of 8,306,000 barrels of daily capacity.

According to figures compiled by the United States Bureau of Mines, available capacity on January 1 of this year stood at 8,006,897, so that an addition of roundly 300,000 barrels would maintain the recommended pace. From reports at hand, it appears that this 300,000-barrel addition will be in place if not all in operation by the year's end.

On the Atlantic Coast a noteworthy event of the year was the completion of Gulf's $50 million expansion program at Philadelphia. Crude stills and fluid cat cracker have been completed and placed on stream. A 16,000 b/d Platformer is under construction but will not be completed until later. One remaining item on the program is a sulfur recovery plant, construction on which has not yet been begun.

Expansion at the Gulf plant began two years ago when it became apparent that the capacity at that time of 107,000 b/d

Phenol Plant at Richmond refinery of Standard Oil Company of California. In this plant cumene is oxidized to form phenol and acetate. It is the first of its kind in the United States.



Continental Oil Company's 45,000-barrel refinery at Lake Charles, La., where $29 million expansion program has been completed.

Scaled to permit engineering study of unit layout, this model is of the 19,000 b/sd Thermofor catalytic reformer under construction at the Beaumont, Texas refinery of Magnolia Petroleum Co. The reforming unit is now 30 percent complete.

would soon be inadequate to take care of market growth in the area. Principal items are the world's largest crude still and the world's largest cat cracker. Crude capacity of the plant now is 183,000 b/d, which makes it the largest refinery on the Atlantic seaboard.

The refinery is designed to process either Kuwait, Latin American or mid-continent crude. At present Kuwait is the principal source of raw material. The Hog Island docks are equipped to unload three supertankers simultaneously.

First of the new units completed was the 63,750 b/d fluid cat cracker built by the M. W. Kellogg Co. It is a "side-by-side" unit, similar to one designed and erected by Kellogg for Gulf at Port Arthur, Texas, in 1951. Erection of the new unit was begun in July 1952, and more than 500 men worked on the project during the peak construction period.

Dimensions of the plant's three main vessels are: 56 feet in diameter by 84 feet in height for the regenerator; 30 feet, 8 inches by 71 feet for the reactor; and 20 feet by 125 feet for the fractionator tower. The regenerator and reactor are lined with Kelcrete refractory concrete.

The cracker circulates 72 tons of catalyst per minute, uses 50,000 gpm of cooling water and 400,000 pounds of steam per hour.

A new cat poly unit was built with a capacity of 2,800 b/d of gasoline.

Another of the new units is a 125,000 b/d atmospheric and vacuum still which is the largest of its kind ever built. The new still is more than 15 times larger than the first distillation unit built at the Philadelphia plant in 1927.

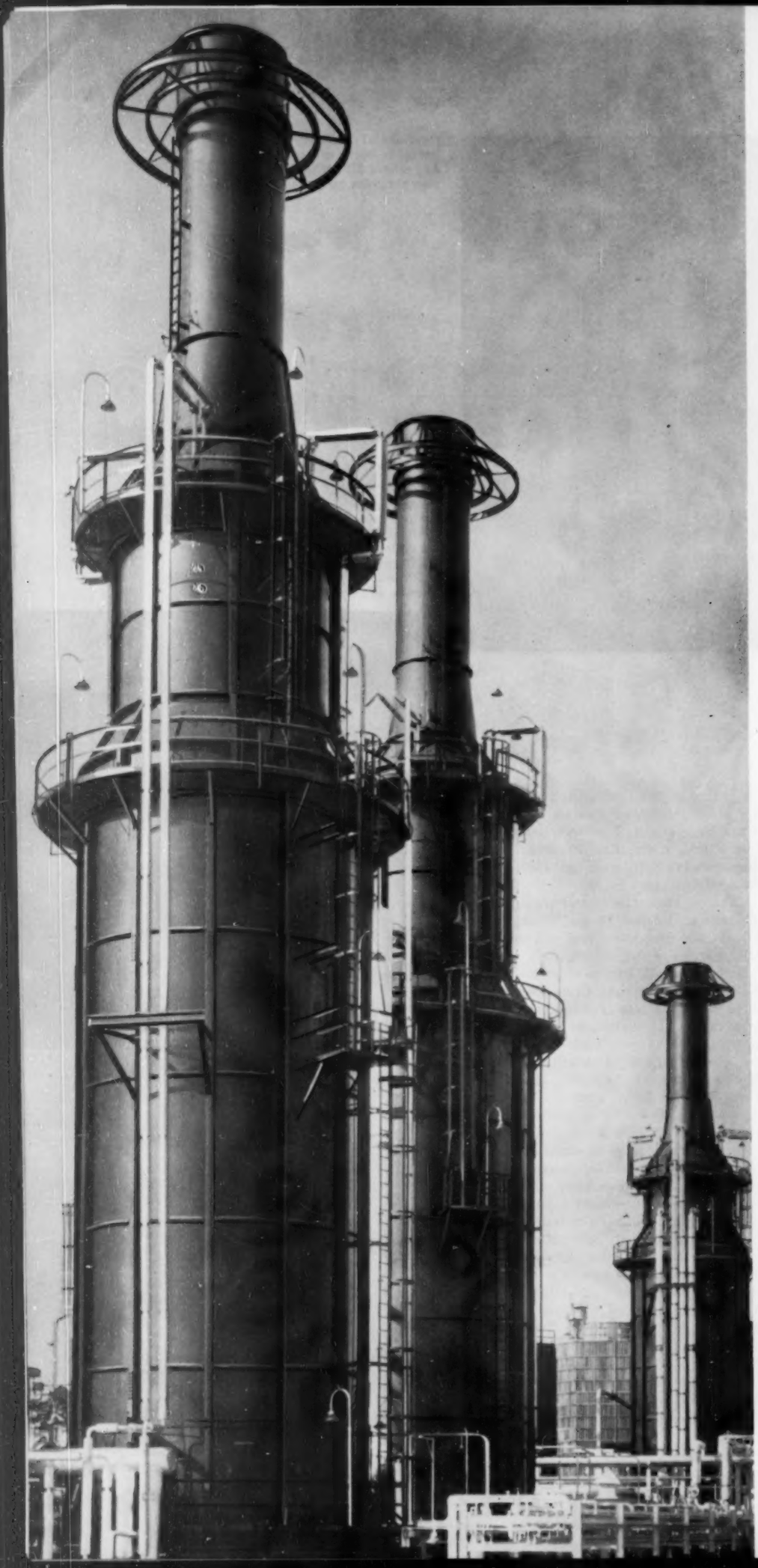
The new atmospheric and vacuum still constructed by the Foster Wheeler Co. covers 8,000 square feet and will consume 2,000 barrels of fuel oil per day.

In addition to the new major units, much auxiliary equipment has been added to bring the total storage capacity to an excess of 11 million barrels. A new tank farm has been built across from the refinery on the Schuylkill River with total capacity of 2,800,000 barrels of storage, and a large addition has been made to the Darby Creek crude oil tank farm, about five miles distant, which gives it a total storage capacity of 2,900,000 barrels. Altogether, more than 30 miles of pipe line have been installed in connection with the recent expansion.

The program has been rounded out by the construction of two ultramodern buildings, one for the administrative personnel of the refinery, the other for the refinery technology laboratory. Completion of the new crude still will permit the conversion of three of the present thermal combination units to visbreaking service.

A new power plant has been erected which will supply the entire plant requirements of 30,000 kilowatts per hour.

New fluid catalytic cracking unit at the Texas City, Texas refinery of Pan American Refining Corp.



Three Petrochem Isoflow heaters at the Wilmington, Calif. refinery of Union Oil Co. Two furnaces in the foreground are rated at 85 and 74 million Btu/hr., while the vacuum furnace in the background is rated at 56 million Btu. The three heaters are processing 38,000 barrels of crude daily.

The steam plant has a capacity of two million pounds per hour.

At the Bayway, New Jersey, refinery of Esso Standard, the Kellogg company is constructing a 60,000-barrel crude distillation unit now approaching completion. At the same plant a hydrofining unit of 21,500 b/d is being installed by C. F. Braun & Co. for the finishing of gasoline and heating oil.

Modernization of Esso's Baltimore refinery now under way will include a platinum catalyst hydroformer, two hydrofiners and a fluid coker. Another extensive modernization program at the company's Everett, Mass., refinery, begun in 1953, is adding a catalytic cracker, a polymerization unit and other improvements to the plant.

Looking to the further extension of its east coast processing facilities, Esso Standard has purchased a tract of land at West Norfolk, Virginia, as a site for possible construction of a new refinery.

One new refining plant is definitely scheduled for erection in Virginia as a result of the decision of Pan American Refining Corp. to construct a multi-million dollar refinery on a 1,200-acre site on the banks of the York River near Yorktown. As originally announced, the plan was to build a refinery of 25,000 b/d capacity, but this was amended in May last to provide for a daily throughput of 35,000 barrels. The refinery will produce unleaded premium gasoline, regular gasoline, aviation spirit of military grades, kerosine, heating oil and industrial fuel.

Tidewater Associated Oil Co. also has announced its intention of building a large new refinery in the eastern area to replace its Bayonne, New Jersey plant which originally began operation 66 years ago. Several sites have been under inspection for location of the projected plant.

In the Philadelphia area, Atlantic Refining Co. is adding a two-stage crude distillation unit engineered by Foster Wheeler to its Point Breeze refinery. Sun Oil Co. has placed a contract for a 27,000 b/d Houdriflow catalytic cracker at its Marcus Hook refinery, construction being in charge of Catalytic Construction Co. The unit will be the largest Houdriflow to date and incorporates a number of innovations. Provision has been made in the plans for later installation of a twin Houdriflow alongside the first cat-cracker.

Sinclair Refining Co. is planning to install a 16,000-barrel catalytic reformer in its refinery at Marcus Hook.

Model B Orthoflow catalytic cracker at the Toledo, Ohio refinery of The Pure Oil Co., the second of its kind installed for Pure by the M. W. Kellogg Co. The "B" model differs from its predecessor principally in that the regenerator is placed above the reactor. This permits a decrease in reactor size and in operating pressures.

Socony-Vacuum Oil Co. has under way a program for installing in seven of its American refineries catalytic reforming facilities to convert more of its low-octane straight-run gasolines into high quality blending stocks. The program extends over 1956 and includes the new refinery at Ferndale, Washington, others in Chicago and the central states and Paulsboro, New Jersey, where the process was developed and where the catalyst employed will be manufactured. Information regarding this product of Socony laboratories is classified as secret, but it is considered highly effective in raising gasoline quality.

At Eagle Point on the Delaware, The Texas Co. is installing a platforming unit of 12,000 b/sd which is one of six that the company is incorporating in its various refineries. This is part of the $275,000,000 program scheduled for additions to properties, plants and equipment for the current year. The company also has under construction at Westville an alkylation plant of 1,850 barrel capacity.

In the central states, Sohio is installing the first large scale Unifining process in its refinery at Lima, Ohio, and at Heath, Ohio, the Kellogg company is constructing a catalytic reformer for Pure Oil Co. In the Toledo, Ohio, refinery of this company, twin orthoflow liquid catalytic cracking units are now in operation and at the Toledo plant of Sun Oil Co. a catalytic reformer is being constructed. At Robinson, Illinois, Catalytic Construction Co. has completed an 8,000-barrel Houdriformer for the Ohio Oil Co. and a catalytic cracker and an alkylation plant are being built. The Texas Co. is about to begin construction at its Lockport and Lawrenceville, Illinois, refineries of platforming units, added alkylation facilities and other new features.

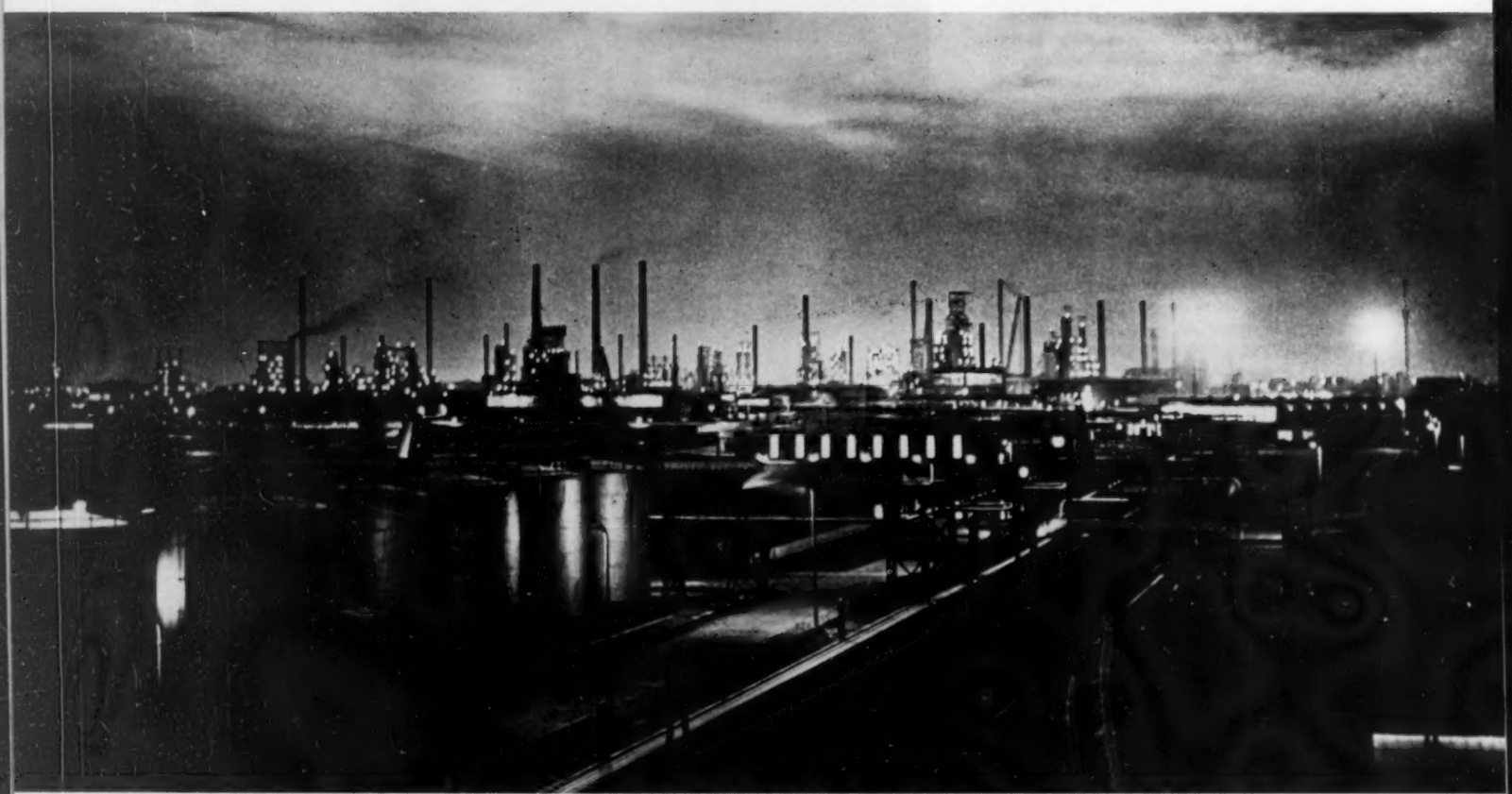
A 6,000-barrel catalytic cracking unit is being constructed at the Bay City, Michigan, refinery of Bay Refining Co. by Southwestern Engineering Co. and polymerization equipment also is being installed. At the Trenton, Michigan, refinery of Socony-Vacuum, an extensive modernization and improvement program is under way.

Late last year Standard Oil Co. (Ind.) announced the development of Ultraforming, described as a new and effective catalytic reforming process for raising the quality of the straight run portions of gasoline. Since that time arrangements have been progressing for introducing ultraformers into several plants of the company and its affiliates and for licens-

(Continued on page 110)

Rotterdam-Pernis Refinery Largest in Europe

A view of the N. V. de Bataafsche Petroleum Maatschappij Rotterdam-Pernis refinery by night. All photos with this article by Shell.



THE ROTTERDAM-PERNIS refinery of N. V. De Bataafsche Petroleum Maatschappij of the Royal Dutch/Shell group is the largest petroleum refinery in Europe, and in addition is probably the most complete with its multiplicity of plant and operations.

About 1900, the choice of the Royal Dutch Petroleum Co. fell on Rotterdam for supplying petroleum products to Western Europe and in particular the Netherlands, Germany and Switzerland. In 1902, the gasoline installation of the Royal Dutch was put into service on the Sluisjesdijk, on the site of the present entrance to the Waalhaven, and a small refinery was added in which part of the imported gasoline was re-pressured for particular applications. This plant had a capacity of 12,000 tons per annum and was the modest forerunner of the present refinery.

Expansions followed in 1907, 1908 and 1919; during the last of these years a 15,000-ton per year asphalt plant was added.

With these expansions and the growth of the municipality of Rotterdam, shortage of space for further development became manifest and by mutual agreement of the company and the municipality it was decided to move the processing and storage installation to another location.

In 1929, the municipality of Rotterdam began the construction of a new petroleum dock at Pernis, opposite Vlaardingen, and this was the site of the new installation of N. V. De Bataafsche Petroleum Maatschappij, the Netherlands operating company, which was founded in 1907 following the merging of interests of the Royal Dutch and the Shell Transport & Trading Co.

It was originally the intention to dismantle the plant at Sluisjesdijk and reerect it at Pernis on an enlarged scale and in a more up-to-date manner, but on further consideration the decision was made to erect a modern refinery with its

Crude oil distilling plant Number 4.

ancillary plants at Pernis. Construction commenced in 1936. This refinery had an intake capacity of one million tons yearly and a storage capacity of 600,000 cubic meters (about 43.5 million U. S. barrels).

Enemy action and removal of vital parts by enemy occupation forces from 1940-1945 caused such serious damage that after the liberation there was doubt whether re-habilitation would be possible. The greater part of the instruments, pumps and other vital parts had been removed from the plants by the enemy and the stores were empty. Of the 300 storage tanks with a total capacity of 780,000 cubic meters which had been erected and in use to May 1940, only two, with a total capacity of 14,000 cubic meters, were still serviceable in May 1945. All the other tanks had been destroyed, badly damaged or removed.

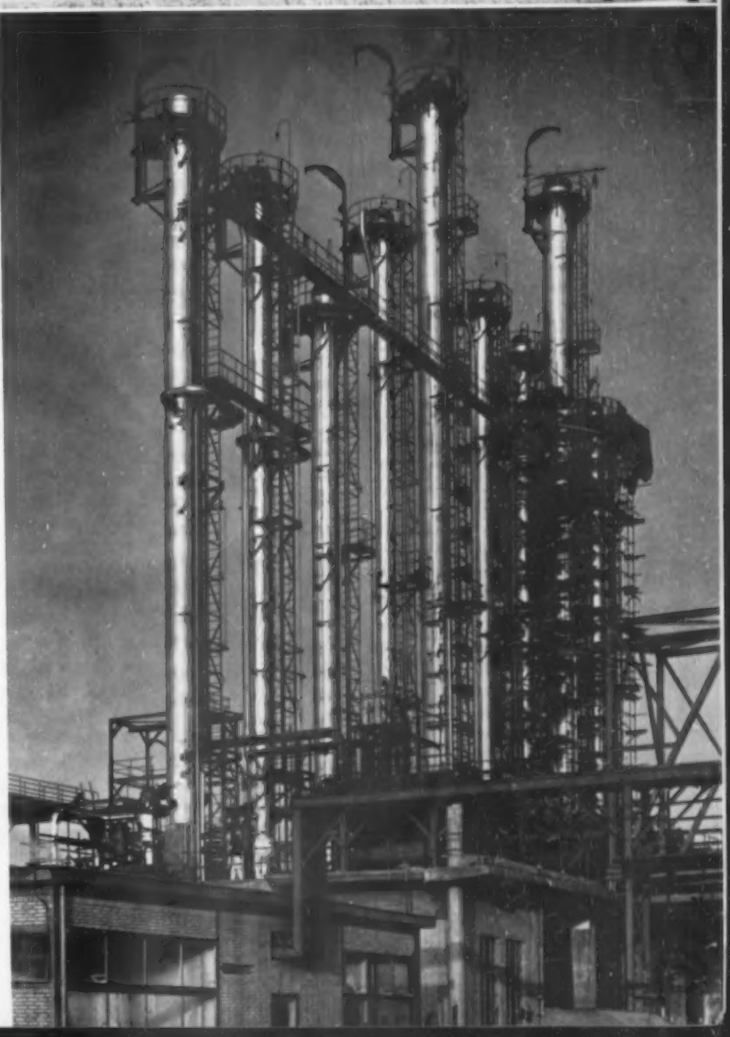
It was decided to reconstruct the refinery and storage, and by August 1946 a new atmospheric crude oil distillation unit with an intake capacity of over 1,000,000 tons of crude per year and its necessary auxiliary plants had been erected and put into commission. By December 1946 the storage capacity was almost at pre-war level.

Increasing demands for petroleum products necessitated an increase in capacity, and a further atmospheric crude distillation unit, a high vacuum distillation unit, a de-waxing plant and a thermal wax cracking plant were added. The wax cracking plant was installed for the production of a base material for the making of detergents, as well as petroleum gases for the manufacture of polyvinyl chloride.

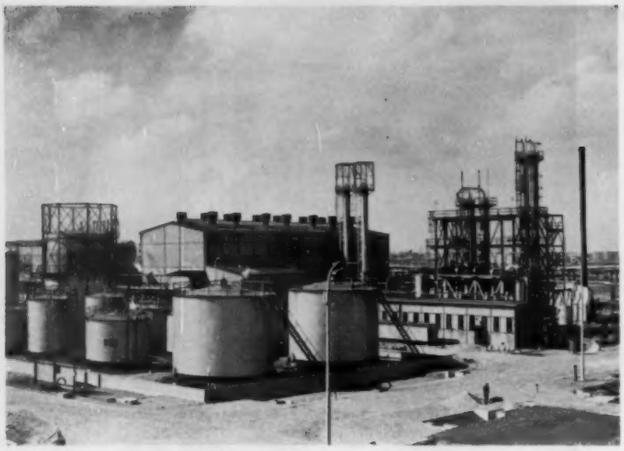
The second stage of enlargement and modernization of the refinery was then commenced. This entailed the erection of a third atmospheric crude distillation unit, a catalytic cracking plant, the first to be completed in Europe, two high-vacuum distillation units, a new gas processing plant, an asphalt blowing plant, new units for gasoline and gas purification, new plants for refining, blending and packaging of lubricating oils, a new filling plant for liquid gases, and in addition the extension of all auxiliary services for the supply of steam, water, electricity, air and fuel.

The workshops and stores were considerably enlarged, a new laboratory was built, and extensive bathing and changing facilities as well as canteens were built.

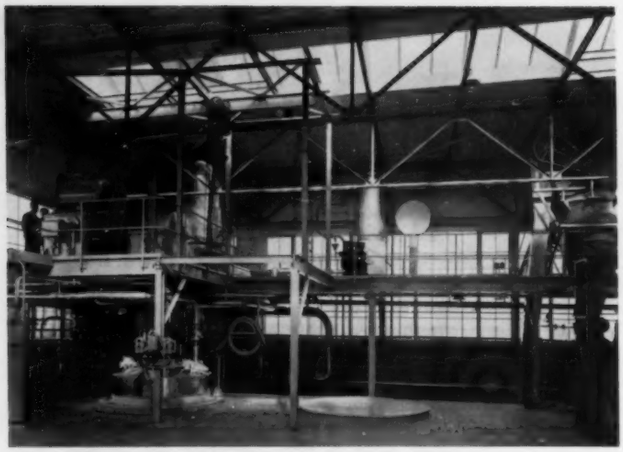
A second petroleum dock was constructed by the municipality of Rotterdam and a large new tank farm, with all the necessary facilities, was built on its southern side, including considerable en-



A solvents plant is under construction.



View of the detergent plant.



Interior of the "Epikote" resins plant.

largement of the pumphouses for handling crude oil and products. Pipe lines were laid under the New Maas from the Pernis refinery to the storage facilities at Vlaardingen.

In recent years the tank farm on the southern side of the second petroleum dock has been considerably extended to cope with the increased refinery throughput.

The third phase of the refinery's extension was begun in 1952 and partially completed in 1953. This entailed the erection of a fourth atmospheric crude distillation unit, with a throughput capacity of more than 3,000,000 tons annually (one of the largest in the world), which came on stream in the summer of 1953. This third phase also includes the building of three plants for the preparation of high-grade engine lubricating oils, a kerosine purifying plant and a third asphalt blowing plant.

An installation has also been provided for the automatic transport of lubricating oil and asphalt drums from the filling plants to shipment jetties.

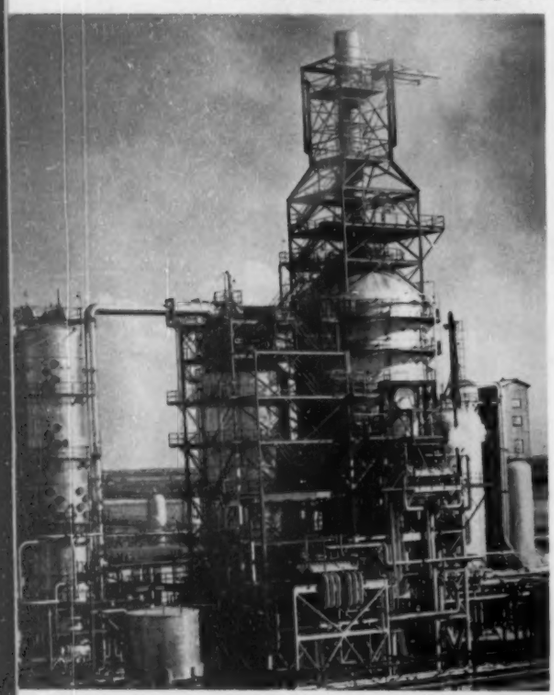
The capacity of the completed refinery amounts to about 10 million tons per year (200,000 b/d) and the larger portion of the throughput is of Middle East origin, with a certain amount from South America, together with approximately 800,000 tons annually of crude from the Schoonebeck oil field in the southeast Drenthe district of the Netherlands, brought in mainly by tanker.

The total water front of the refinery, including the tank farm, is four miles long. There are 24 jetties, six for general cargoes and 18 for liquid cargoes. At the latter, 10 supertankers (44,000 dwt) can be handled simultaneously. Crude oil can be received into storage at the rate of 10,000 cubic meters per hour and finished products can be loaded at the same rate.

The four atmospheric crude distillation units have a total input capacity of 30,000 tons per day, taking off overhead light gasoline and gas, with heavy gasoline, white spirit, kerosine and light and heavy gas oils as side streams and a heavy residue as thermal cracking stock or as feed for the high vacuum units.

There are four high vacuum distillation units, from which overhead light gas oils are taken, with waxy lube oil distillates as side streams and a heavy residue, which is used partly for blending as fuel, partly for processing of asphalt and partly for the manufacture of bright stock, after propane de-asphalting.

View of the catalytic cracking plant.



When used for the manufacture of asphalt, it is further treated in one of three asphalt blowing plants, where it is blown with air for the making of various grades of asphalt for roadbuilding or industrial purposes. Asphalt emulsions are made in a separate plant. Asphalt is delivered in bulk (road or rail tanks or lighters) or in drums. Some hard grades are delivered in the form of cast blocks.

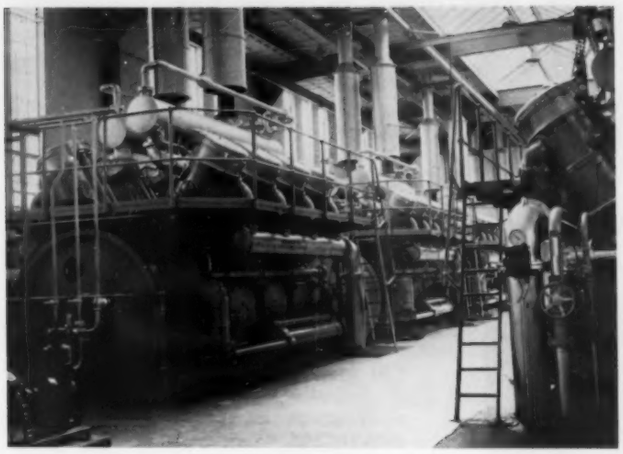
The portion of the vacuum residue for cracking is treated in one of two thermal cracking units with a total daily capacity of 3,000 tons. In one unit a large part of the residue, or a heavy crude oil which can also be used as a base material, is cracked for gases, gasoline and liquid cracked residue for blending fuel. In the other unit deep cracking takes place, giving a coke residue for which there is a good demand.

The other portion of the atmospheric residue is treated with propane in the de-asphalting plant, in which asphalt is removed from the residue leaving a viscous asphalt freestock for the manufacture of bright stock. Propane is separated from each product and passed back for further use in the process.

The major portion of the overhead and waxy side streams from the vacuum units serves as feed stock for the fluid catalytic cracking plant, but a portion is used for the preparation of high viscosity-index lube oils. These fractions are furfural treated, as is the de-asphalted residue from portions of the high vacuum residue.

The raffinate from the solvent treatment with furfural is separated and then de-waxed using MEK and benzene, with propane as refrigerating agent, the wax being separated in rotating filters. The de-waxed fractions are finally clay-treated and then blended to specification for lubes. The slack wax from the filters is used for the manufacture of detergents.

The portion of the overheads and side streams from the vacuum units not used for the manufacture of lubes forms the



Compressor room of the catalytic cracking plant.

Control room of distilling plant Number 4.

feedstock for the 4,500-ton per day fluid catalytic cracker. The catalyst used in the cracker is a mixture of aluminum and silicon oxides in the form of a very fine powder and not a microspheroidal catalyst.

The uncondensible gases formed in the various cracking processes are further treated in two gas processing plants. In these the lighter gases are separated by distillation at high pressure from the petroleum gases which liquefy under pressure (i.e. butane/butylene and propane/propylene). They are then purified for the removal of sulfur compounds. Part of these sulfur compounds is sold as such and part is processed to sulfur in one of the chemical plants.

Part of the purified uncondensible gases is delivered to the gas works of Rotterdam, The Hague and other towns in the province of South Holland, the remainder being used as refinery fuel.

Part of the purified liquid gases is marketed as "Shell Butagas" or "Shell Propagas," either in bulk or in small cylinders; the remainder goes to the chemical section of the refinery to serve as base material for synthetic chemical manufacture.

Other plants in the refinery are those for purifying gasoline, kerosine, white spirit and other special products as well as a redistillation plant for the production of special boiling range petroleum spirits.

There is also a thermal reforming plant of 1,200 tons per stream day capacity for up-grading the heavy benzene from the primary crude distillation.

The storage capacity of the installation amounts to about 2,000,000 cubic meters, distributed over about 800 tanks.

The daily consumption of utilities is as follows:

Steam—6,000 tons
Cooling Water—450,000 cub. meters
Electricity—350,000 kwh
Fuel Oil—600 tons
Fuel Gas—700,000 cub. meters

In the normal operations of the refinery at Rotterdam-Pernis and of the storage installation at Vlaardingen, some 4,000 persons are employed, while in addition several hundreds are engaged on new construction and other work.

Skilled workers have been drawn from all parts of the Netherlands, and to accommodate them, 600 houses have been built at Vlaardingen. This number, however, is not sufficient and the municipalities of Vlaardingen and Rotterdam have put an even greater number of houses at the company's disposal, some 750 of which are already occupied.

A large sports ground (the BPM sports ground "De Vijfsluizen") was opened at Vlaardingen in the summer of 1953.

Chemical plants at Pernis-Rotterdam have been built side by side with the refining plants and take their base stock from them.

One of the first chemical units, which dates back to 1949, was that for the manufacture of detergents. The base stock for these products is the slack wax, which is obtained in the MEK benzol de-waxing of the lube distillates. This slack wax, on cracking, yields (in addition to light products) a distillate which, after treatment with sulfuric acid and alkali, is worked up to a finished detergent.

This detergent, "TEEPOL," is supplied to the soap-making industry, among others, in the form of a liquid, flakes or powder for processing into products for domestic use, for general cleaning purposes, and to various industries for use (among others) as a wetting agent.

In 1949, a plant for the manufacture of the base material for plastics of the polyvinyl chloride type was erected. Ethylene is the starting material for this process which, when reacted on by chlorine, forms dichlorethane. This is then converted to vinyl chloride, which on polymerization yields polyvinyl chloride.

It belongs to the thermoplastic group in that it becomes soft when heated and can then be moulded or extruded into various shapes and can be rolled into thin but strong transparent sheets.

The cracked gases from the refinery are also used for the manufacture of various solvents. The propane-propylene gas is converted into isopropyl alcohol, which is used as a base material for the manufacture of acetone, which in its turn is used as a base material for other syntheses, in which catalysts play a large part, such as the manufacture of diacetone, alcohol, methyl isobutyl ketone and methyl isobutyl carbinel.

In the spring of 1953 a plant for the production of "EPIKOTE" resins was put into operation. "EPIKOTE" is a registered trademark for a product which belongs to the group of epoxy resins which have been developed in recent years. They are used largely in the paint and lacquer industry as base materials for protective paints with special properties, as cast resins, and as base materials for the manufacture of adhesives and laminates.

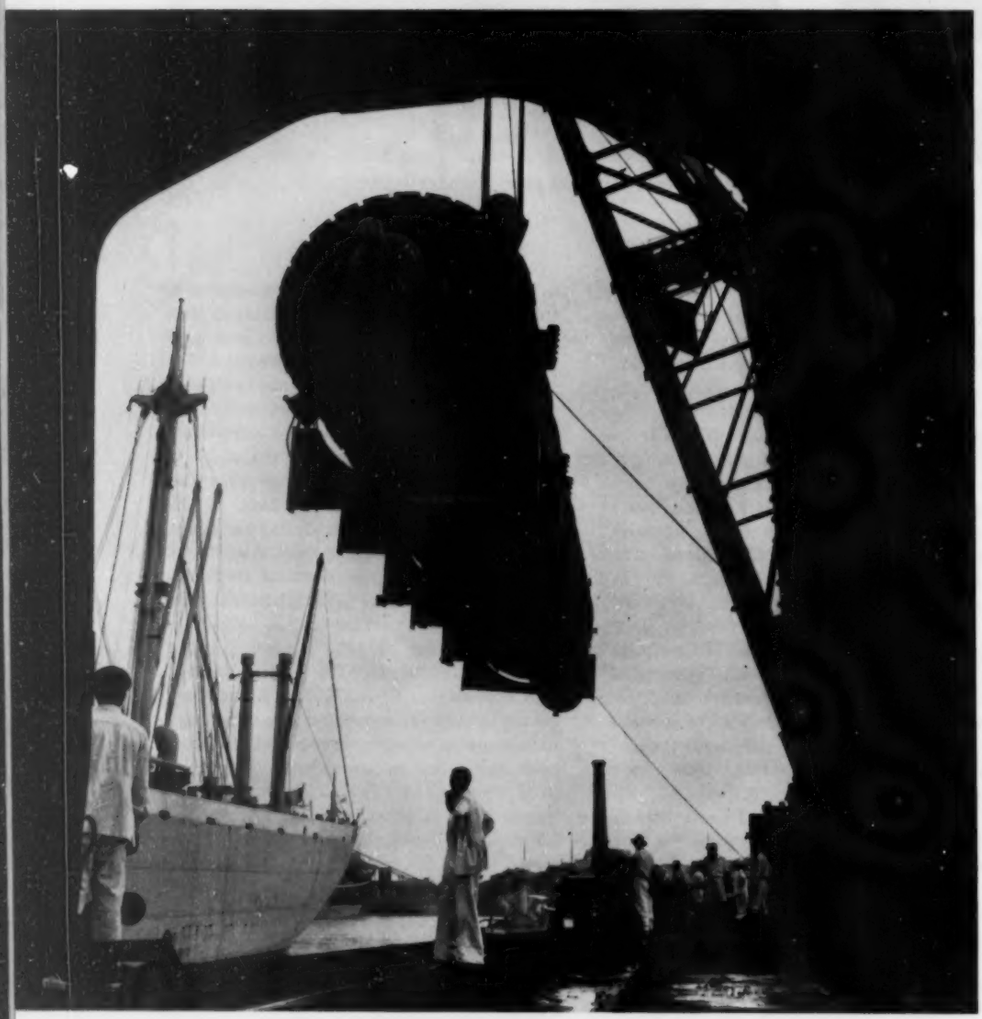
A plant for the production of elemental sulfur from the sulfurous gases obtained in the purification of the cracked and refinery gases has been erected and is in production.

Using bauxite as a catalyst in a Claus kiln and under controlled oxidation, elemental sulfur is produced. Part of the sulfur produced is marketed as such and part is processed to sulfuric acid for use in the refinery.

Finally, in the early part of this year, erection of a plant for the manufacture of the well-known insecticides Aldrin and Dieldrin, which have been successfully used in many countries, was begun.

Thus it will be seen that the Pernis-Rotterdam refinery, in addition to having the largest throughput of any refinery in Europe, is probably also the most comprehensive in the number and variety of the products manufactured by one organization.

Biggest and heaviest object ever unloaded at Bombay harbor was this tower for the new Standard-Vacuum refinery. Photo courtesy Standard Oil Co. (N.J.)



Eastern hemisphere review

AS A RESULT of the vigorous program of refinery construction carried forward during the past five years, the United Kingdom now can lay claim to the position of third largest among the world's refining nations, excluding the Soviet Union, and is easily first among the countries of Western Europe. Design capacity of its operating refineries amounts to slightly more than 29,500,000 tons *per annum*, or over 600,000 b/d.

The target set at the commencement of the program, 20,000,000 tons per year, has been greatly exceeded so that Britain is now an exporter on balance though still importing certain petroleum products. Cost of new construction and plant enlargement is estimated at roundly $540,000,000.

The growth of refining capacity has produced its problems, foremost of which is the fact that the margin between tax and retail price is so narrow as to rule out price reduction and to make the quality of motor spirit, particularly in premium grades, the main competitive factor. When one considers that the inland revenue tax stands at 2/6d (35 cents) an Imperial gallon or 56 percent of the service station price of 4/5½d, it leaves only 1/11½d (21 cents) to pay all expenses of production, distribution and marketing, so that all companies are stressing additives and refining methods in their sales slogans and are seeking to introduce means of raising the octane ratings of their products. Present octane ratings, research method, are about 93 for premium grades and 75 for standard. Indications are, however, that these may be raised in an effort to win the favor of owners of the newer cars with higher compression ratios.

With the entrance into the marketing arena of Coryton refinery,* the newest large plant to be put on stream, it would seem that there might be a pause in refinery building. Most of the changes in British plants during recent months, in fact, have been in the addition of new units or the introduction of processes designed to improve products or contribute to more economical operation.

In the great Fawley refinery of Esso Petroleum, a main feature of construction activity during the year now ending has been the completion and bringing into commission of the lube plant which was the third part of the original program. Among the various installations in this department are the phenol solvent treating unit and the propane dewaxing plant, both of which are the first of their kind to be installed in England. The clay contacting unit finishes the basic grades of lubes which are then shipped to the company's two plants at Wandsworth and Birkenhead for blending. An addition to the original Fawley program is the hydrogen-desulfurization treatment of white spirit to meet the special requirements for this product.

* See WORLD PETROLEUM, July 1954

Artist's drawing of ground plan for Baghdad refinery of the Government of Iraq.

An important addition to the Stanlow refinery of Shell Petroleum Co. is the erection of a sulfuric acid plant which has been completed and is scheduled to go into operation within another month.

The feed for this unit is waste acid sludge from various processes, augmented by hydrogen sulfide separated from uncondensible gases produced by the catalytic cracker, and is the first of its kind to be erected in the United Kingdom for the recovery of sulfuric acid from acid sludge, a waste product usually difficult to dispose of.

A 10,000 b/d Platforming unit has been completed and put into operation at this refinery, producing components for blending into high octane aviation spirit.

A hydro-desulfurization unit is under construction based on a new process developed by Shell.

This process differs from the conventional vapor phase procedure in that desulfurization is effected by a "trickle" technique in which the feedstock to be desulfurized is trickled in liquid form over a bed of catalyst in the presence of hydrogen under pressure. A sulfur reduction of 89-90 percent can be effected with little or no attack on any cracked or highly aromatic compounds present in the feedstock. As the feed stock does not have to be vaporized, the new process is economical in fuel and heat transfer; power is required, however, for the hydrogen compressors. The unit is estimated to cost about $2,800,000 and is scheduled to go on stream this year.

The large expansion in refining activity has necessitated the provision of increased storage facilities and several more storage tanks are being added.

The main post-war expansion of the Llandarcy refinery of Anglo-Iranian Oil Co. was completed during 1953 with the bringing into operation of the lube oil section, which includes propane deasphalting, furfural extraction, MEK dewaxing and high temperature clay contacting.

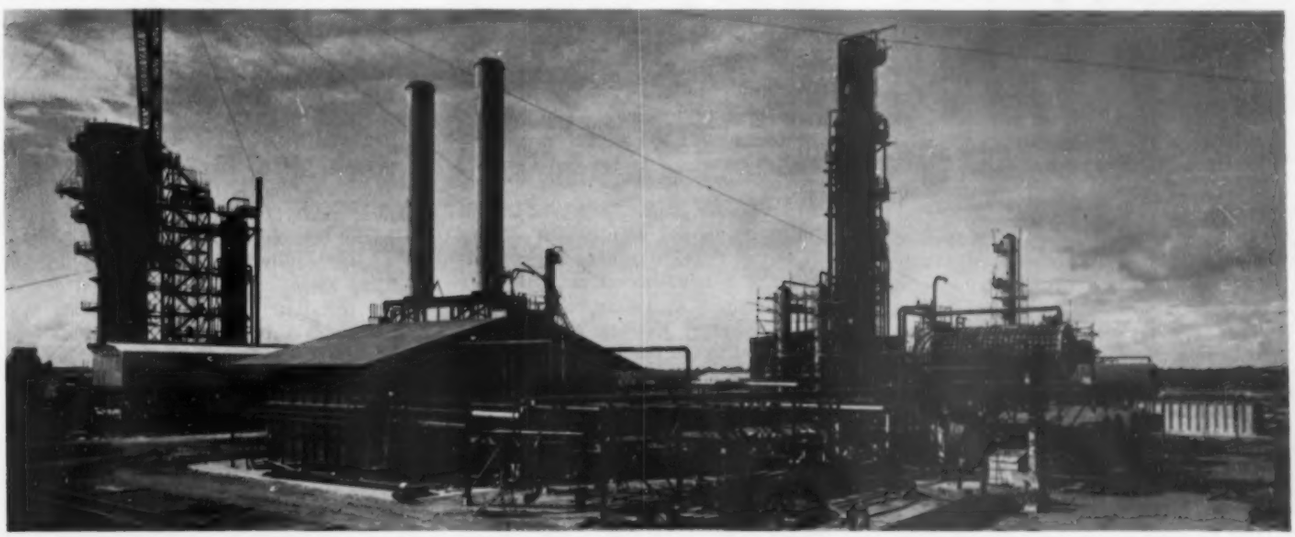
As an addition to the original expansion scheme, a 6,000 b/sd Platforming unit is being installed and is due to go on stream early in 1955. The erection of this plant is in the hands of D. & C. & William Press Ltd. Additional tankage is being erected to provide for the increased range of products from the lube oil plant, and two Hortonspheres for the storage of butane are being constructed.

Construction work on the new Kent refinery of Anglo-Iranian has now been completed and the various units are in operation at full capacity. A new unit now being erected is a 6,000-barrel Platformer which is scheduled for completion before the end of the year.

By plant adjustment, the capacity of the company's Grangemouth refinery increased by 5,000 b/d and is now operating at 55,000 b/d. A Girbotol plant, a catalytic polymerization unit and a sulfur recovery plant are in course of erection and are scheduled for commissioning later in 1954. New bottling and storage facilities for gas are being built.

Following the addition of an atmospheric distillation unit to the Manchester

Topping plant area of the new Anglo-Iranian Oil Co. refinery at Kwinana in western Australia.



Sulfur recovery plant and catalytic polymerization unit at Esso Petroleum Company's Fawley, England, refinery.

refinery, this plant is operating with a steady throughput at the rate of 150,000 tons per year. A new automatic continuous lube oil blending plant manufactured by the Cornell Machine Co. has been put into operation. It consists of two sections: a proportioning panel and a homogenizer. Blend components are drawn from storage by proportioning pumps and fed in constant pre-determined ratio to the homogenizer. An accuracy of 0.1 percent of each component is achieved.

The new two-stage Foster Wheeler distillation unit at the Kingsnorth refinery of Berry Wiggins & Co. was brought on stream late in March this year and is working satisfactorily at 2,200 b/d on Venezuelan crude.

Alterations are being made at the Weaste refinery, including installation of a new vertical upshot heater, additional fractionating and shipping columns, with ancillary equipment now nearing completion.

All the larger continental countries of Western Europe have added substantially to their processing facilities and several of them, including France, Italy, Belgium and the Netherlands, like the United Kingdom, are in a position where exports are necessary to keep their plants in full operation. The refining situation in France and Germany is dealt with in separate articles appearing on other pages of this issue. Italy has continued to elaborate its processing facilities during the current year and now ranks third after Britain and France with a refinery capacity close to 20 million tons per annum.

Important additions to Italy's processing facilities during the current year have been the enlargement of the STANIC refinery at Leghorn to 32,000 b/sd, additional installations at INPET, La Spezia, which raise its daily throughput to 30,000 b/sd, the increase of IROM's Marghera plant at Venice to 33,000 b/sd and the opening of the new Condor* plant at Rho near Milan with a daily charging capacity of 15,000 barrels. STANIC's expansion included the installation of a 21,000 barrel, two-stage atmospheric and vacuum distillation unit, phenol solvent treating and propane dewaxing units which, with the reconditioned duosol plant, provide for an output of 90,000 metric tons of lubricants per year. A hydroformer of 8,000 b/sd is in course of construction and due for completion in 1955.

At La Spezia, a new 2,800 b/sd thermal reforming unit has been put into operation and at Porto Marghera the commissioning of a 1,400-barrel catalytic polymerization unit operating on gases from the 6,000-barrel Kellogg reformers has contributed to the plant's efficiency. With the completion of acid and clay treating units in November last, industrial lubricants are being produced for the first time at this refinery.

Although the rise in Italian consumption of petroleum products for the three years 1951-1953 averaged nearly 10 percent, the growth of refining capacity doubled domestic requirements and has aggravated the export problem, as the gain in internal demand can hardly be expected to maintain its earlier high rate indefinitely.

Elsewhere in Europe a lube plant of 27,000 tons yearly capacity is being built by Foster Wheeler as an addition to the Escombreras plant in Spain to be completed in 1955. The Cobo Ruivo refinery in Portugal is completing its plant with a Koch 27,000-barrel topping unit, a cracking installation of 5,000 b/sd and a reformer of 2,500 b/sd.

At Antwerp, Belgium, the new refinery of Esso Petroleum is now in full operation at 27,000 b/d. LPGas facilities are being installed with completion scheduled for late 1954.

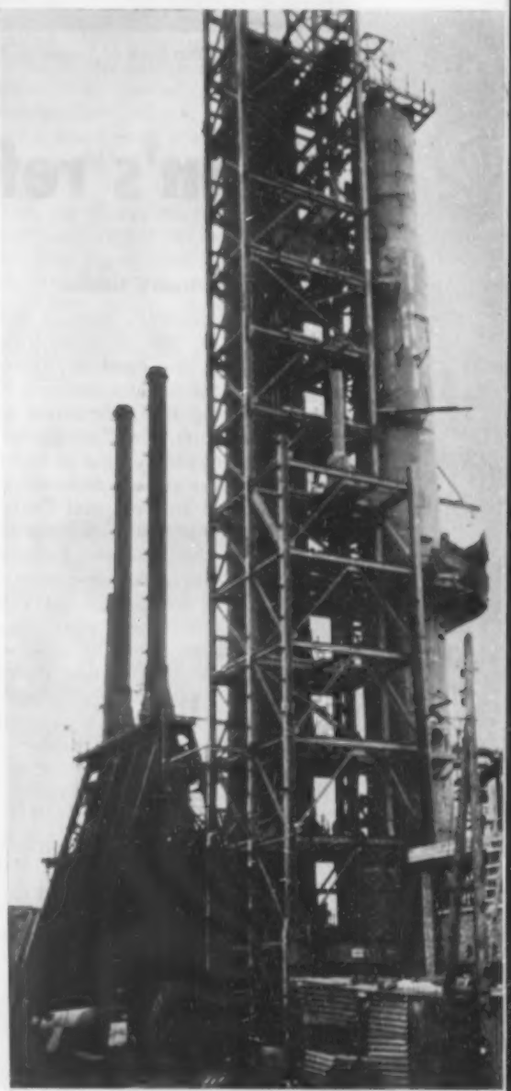
At Antwerp also, Soc. Belge de Petroles, jointly owned by Anglo-Iranian and Petrofina, is being supplied with a fluid catalytic cracking plant of 10,000 barrel capacity by The Lummus Co. and a UOP catalytic polymerization unit of 3,000 barrel capacity. A thermal cracking installation is to be revamped into a vacuum distillation unit to provide feed stock for the catalytic cracker and an atmospheric distillation unit of 20,000 b/d capacity. These alterations will enable the refinery's capacity to reach 60,000 b/sd. Tankage, offsite facilities and services generally are being enlarged to care for the increased throughput.

Albatros S.A. Belge pour le Raffinage

* See WORLD PETROLEUM, July 1954

Left: New STANIC refinery at Livorno, Italy. Photo courtesy Standard Oil Co. (N.J.)

Below: Houdriflow catalytic cracking unit at Antwerp, Belgium, refinery of Albatros S.A. Belge pour le Raffinage de Petrole. The 3,600 b/d cracker is an important part of Albatros' current building program.



de Petrole of Antwerp has added to its plant a Houdriflow unit of 3,600 b/d capacity which is to go into operation in July of this year.

In Yugoslavia the government refinery at Bosanski Brod has been enlarged and modernized by the erection of a new combination visbreaking, thermal cracking unit and thermal reforming unit. Erection was by Friedrich Uhde of Dortmund, Germany.

Capacity of the thermal cracking section of the plant is 2,800 b/d, and of the reforming unit is 1,000 b/d of 435 end point straight run naphtha, according to a recent report in *Nafta*.

The plant has two heaters, one for reforming, and one for cracking and visbreaking operation. The raw naphtha after heat exchange is heated in the reforming heater in a once-through operation under a pressure of 750 psi to the cracking temperature of 1,030°F, and after quenching, is introduced to a combination tower. The atmospheric residue, after heat exchange, enters the tower where it is mixed with a heavy recycle oil and sent to the visbreaker. A light recycle-distillate is withdrawn from the combination tower and cracked under a pressure of 750 psi at 1,000°F. The products obtained by cracking and visbreaking are passed to the combination tower where a heavy cracked tar, a heavy and a light recycle oil, cracked gasoline and gas are obtained.

The residue is rerun and stripped of its light constituents in a separate vacuum tower, the residue of which is heavy tar. The top and side streams serve as reflux to the combination tower and, further, as recycle stocks.

Overhead products are treated in vapor phase in two alternately operating Gray towers. The separated polymers are introduced in the combination tower for recracking.

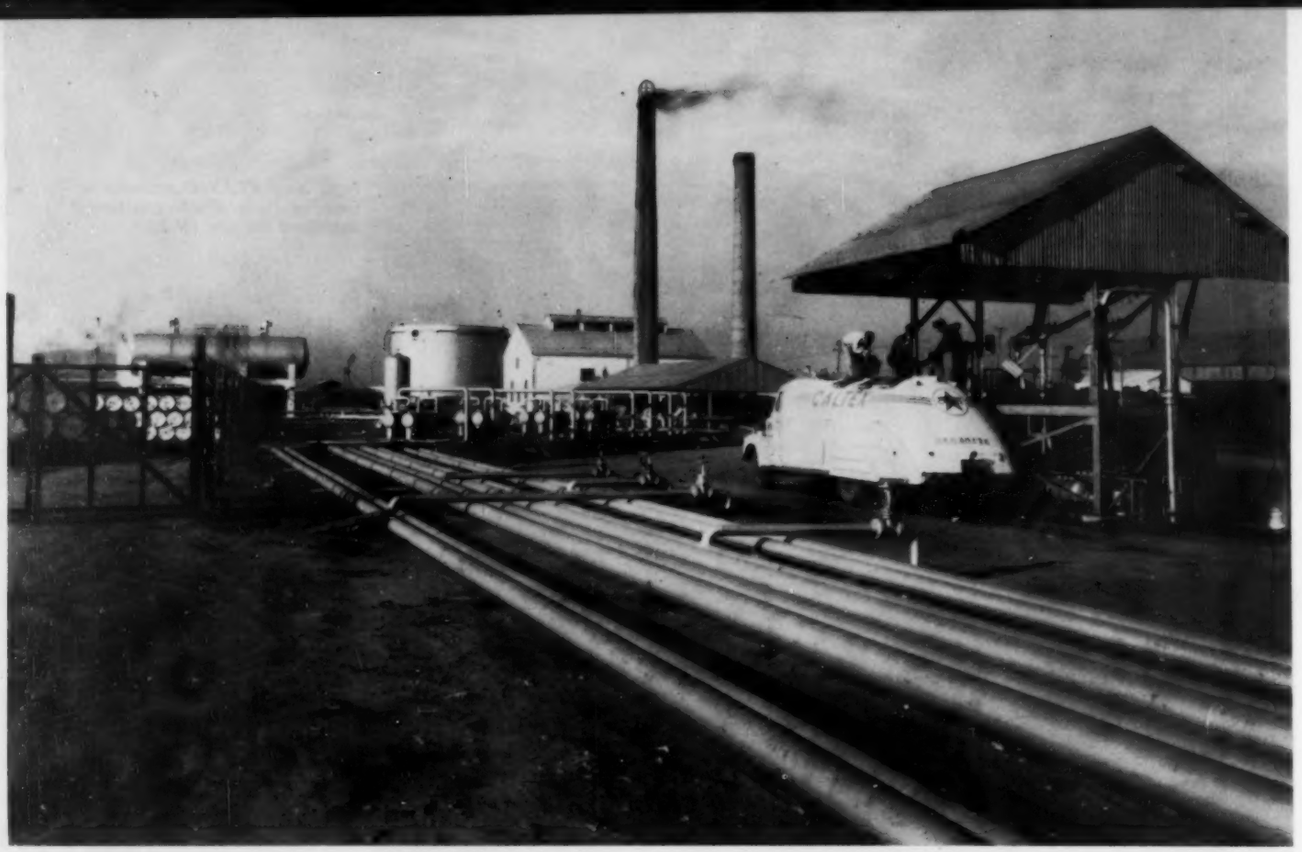
In furtherance of the Greek ambition to have an oil refinery within the country's own borders, the government has been holding discussions with international groups, but no final decision has been announced.

As usual, specific information as to refining operations within the Soviet Union and its satellites is lacking, though reports of increased capacity without details appear occasionally. The assumption is that capacity is keeping pace with production, now estimated at around 1,200,000 b/d.

South Africa marked its entry into the ranks of major refining with the opening of Standard Vacuum's 25,000 barrel plant at Durban, which went into operation at the beginning of 1954.* A second refinery is now being completed by the M. W. Kellogg Co. at Coalbrook, about 50 miles from Johannesburg, for SASOL (South African Coal, Oil and Gas Corp.). This, however, will produce gasoline and other liquid hydrocarbons, chemicals and waxes from coal by synthesis. The site spreads over an area of some 5,000 acres, and

(Continued on page 114)

* See WORLD PETROLEUM, June 1954



Tankwagon loading dock at Yokohama. Photo by Nippon Sekiyu.

Japan's refiners beset by problems

By Stuart Griffin

JAPAN'S OIL INDUSTRY faces a difficult situation at the present time. It is menaced on one hand by aggressive threats from the colliery interests which are importuning the government to restrict oil imports. Coal companies are striving to keep their output at 48 million tons for the year and are demanding that the Ministry of International Trade and Industry cut imported oil by one to one and a half million hectoliters on the claim that a drop in coal production to or below 43 million tons will inflict heavy losses and lead to the collapse of small concerns.

It has been the policy of MITI to encourage the use of oil rather than coal, a step inaugurated when coal prices were abnormally high. The quota set for heavy oil imports during the current year was placed at 5,370,000 kiloliters*, the same as in 1953. The question that causes concern to oil importers is whether MITI will stand firm by this decision or will seek a compromise between the views of collieries and refineries.

Guided by the Economic Counsel Board, and seeking to guard Japan's dwindling foreign exchange, the government has resorted to stopgap measures while trying to find how to limit major oil imports rather than affording importing relief.

*One kiloliter equals 264.2 U. S. gallons.

Refiners face another problem in a stockpile situation that varies from acute shortage to complete unavailability. Tankers are lying idle at loading ports with no foreign exchange available to open letters of credit. Some firms have their imported oil in bonded tankers unable to go through import procedures for lack of exchange.

MITI has finally decided to (1) prohibit (after October) use of heavy oil for heating, cooking, and bathing; (2) to limit sales volume for each wholesale distributor, and (3) to set up a Heavy Oil Demand and Supply Adjustment Council.

But petroleum in Japan means more than simply heavy oil. The nation, anxious to build its industry, wishes to purchase crude oil and products. It wants to encourage the growth of its petroleum industry, but is dependent on foreign exchange to permit the importation of sufficient stocks.

Oil import limit will be around 9.5 million kiloliters (60,000,000 barrels), almost the same as for fiscal 1953. To use foreign funds as efficiently as possible, crude oil will be imported as a rule, avoiding where possible refined or semi-refined purchases.

Japan's refining capacity will climb to 8,272,000 kiloliters (54,000,000 barrels) this year, an expansion of about seven percent above the 1953 level. The remaining 1.3 kiloliters will be brought in in either a refined or a semi-refined state.

Import duty, hitherto exempted in practice, will be put in force and industrialists will be urged to shift from oil to coal again. Government agencies will urge less gas consumption by motor vehicles, especially private passenger cars. Oil will be distributed to industries in accordance with their importance to the industry over-all.

The foreign exchange budget for the first half of fiscal 1954 indicates the government will allot no more than $135 million for import of petroleum products during fiscal 1954. This allocation enables Japan's oil refineries to work on 125,000 barrels of crude per day on the average for the whole fiscal year. This daily average volume is some 25,000 barrels greater than during fiscal 1953 and therefore, once the exchange has been received, according to MITI authorities, would develop no shortage in crude oil supplies for the 12-month period.

It does, however, represent a considerable decrease in comparison with the daily average of 129,000 barrels originally estimated by MITI, this being due to the fact that the government has cut the crude oil import estimate in order to import an additional 100,000 kiloliters of gasoline.

To cover the decreased heavy oil supply that would result from the crude oil import cut, the government may raise the

annual heavy oil import from the original estimate of 2,046,000 to 2,218,000 kiloliters. It is believed that the supply and demand position of kerosine and light oils will be much disturbed, since the foreign exchange budget covers enough for crude oil imports this year.

A rise in prices for all petroleum products seems inevitable, however, since supplies in general will vary from scanty to short. But this increase probably will not occur until the latter half of the year and, if the economy favors, additional foreign exchange might be allotted to redress the supply-demand imbalance and perhaps keep prices down for most of fiscal 1954.

Japan receives its petroleum from abroad as follows, taking calendar year 1953 as a base:

COUNTRY	KILOLITERS	% OF TOTAL
United States	176,147	3.06
Venezuela	11,721	0.20
New Guinea	155,269	2.70
N. Borneo-Seria	890,735	15.52
Sumatra	77,424	1.35
Saudi Arabia	3,835,632	66.81
Kuwait	434,913	7.58
Iraq	26,308	0.46
Qatar	133,187	2.32
Total	5,741,336	100.00
	(36,000,000 bbls.)	

For refined products brought into Japan during the calendar year 1953, the Ministry of International Trade and Industry provides these statistics: 304,331 kiloliters of gasoline; 68,790 kiloliters of light fuels, and 2,474,178 kiloliters of heavy oils.

Crude imports are processed at 18 Japanese refineries, seven on the Japan Sea side, 11 on the Pacific Coast.

Principal oil companies in Japan are: Japan Oil Products Co. (Nippon Sekiyu); Showa Oil Co.; Mitsubishi Petroleum; Toa Fuels (Toa Nenryo); and Koa Oil Co. Others, somewhat smaller, include: Idemitsu Kosan, Daikyo, Maruzen, Japan Oil Storage, and General Bussan (trading) companies.

The industry has staged a remarkable comeback from the destructive rain of ruin during World War II, primarily through United States engineering, technical tie-up, and financial assistance. The large Japanese concerns maintain close connections with American oil firms.

Some of these connections are: Japan Oil Products and Caltex; Showa and Shell; Mitsubishi and Tidewater Associated; Toa Fuels and Standard-Vacuum; Koa and Caltex—all of which are joint capital corporations.

In Japan Oil, Showa, Koa, and Mitsubishi, the total stocks outstanding are held jointly with the American firms, 50-50, while in the Toa-Standard-Vacuum tie-up, the balance is 55-45.

Domestic production figures show a marked and steady increase: in 1949, 163,124 kiloliters; 1950, 1,559,500 kiloliters; 1951, 2,890,728 kiloliters; 1952, 4,486,535 kiloliters; and last year (calendar), 5,775,644 kiloliters.

Japan now has several postwar associations, chief of which are the Oil Refiners Co-operative Association, the Oil Importers and Distributors Association, and the National Oil Co-operative Association (wholesalers).

A Japanese oil firm, the Imperial Oil Co., has been reported to be seeking oil concessions in the Middle East. Imperial is said to have sounded out the Syrian Government on the subject. Imperial is reportedly ready to invest three million dollars in exploration and drilling.

Other firms are interested elsewhere: Japan Oil Products in Sumatra and the Celebes; Daikyo in the territory outside the Arabian neutral zone; and Maruzen and Mitsubishi in South America.

Fiscal 1954 will almost certainly not be a year for conventional petroleum industry expansion owing to the financial situation, but strong competition in products associated with petroleum is developing among Japanese, American, and British oil interests.

The Koa Oil Company in Tokyo, half of whose stock is held by Caltex, plans to set up an intermediate plant for oil products manufacturing with Teikoku Rayon in Osaka city. This firm will make synthetic fibers from acetone and other raw materials.

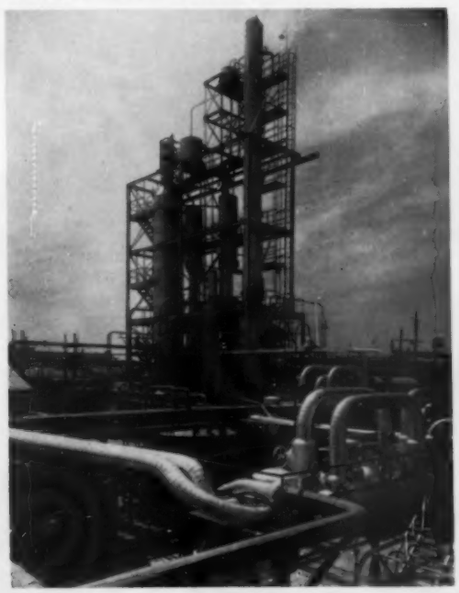
Shell Oil Company has decided to establish a similar firm jointly with the Mitsubishi Chemical Industry Company in Tokyo and plans to turn out 3,000 tons of acetone a year for the manufacture of acetate.

Six Japanese oil companies, including Koa Oil, Nippon Oil Products and others, have plans to make an advance in this industrial field through purchase of facilities of the former army oil depot in Iwakuni City, south of Osaka.

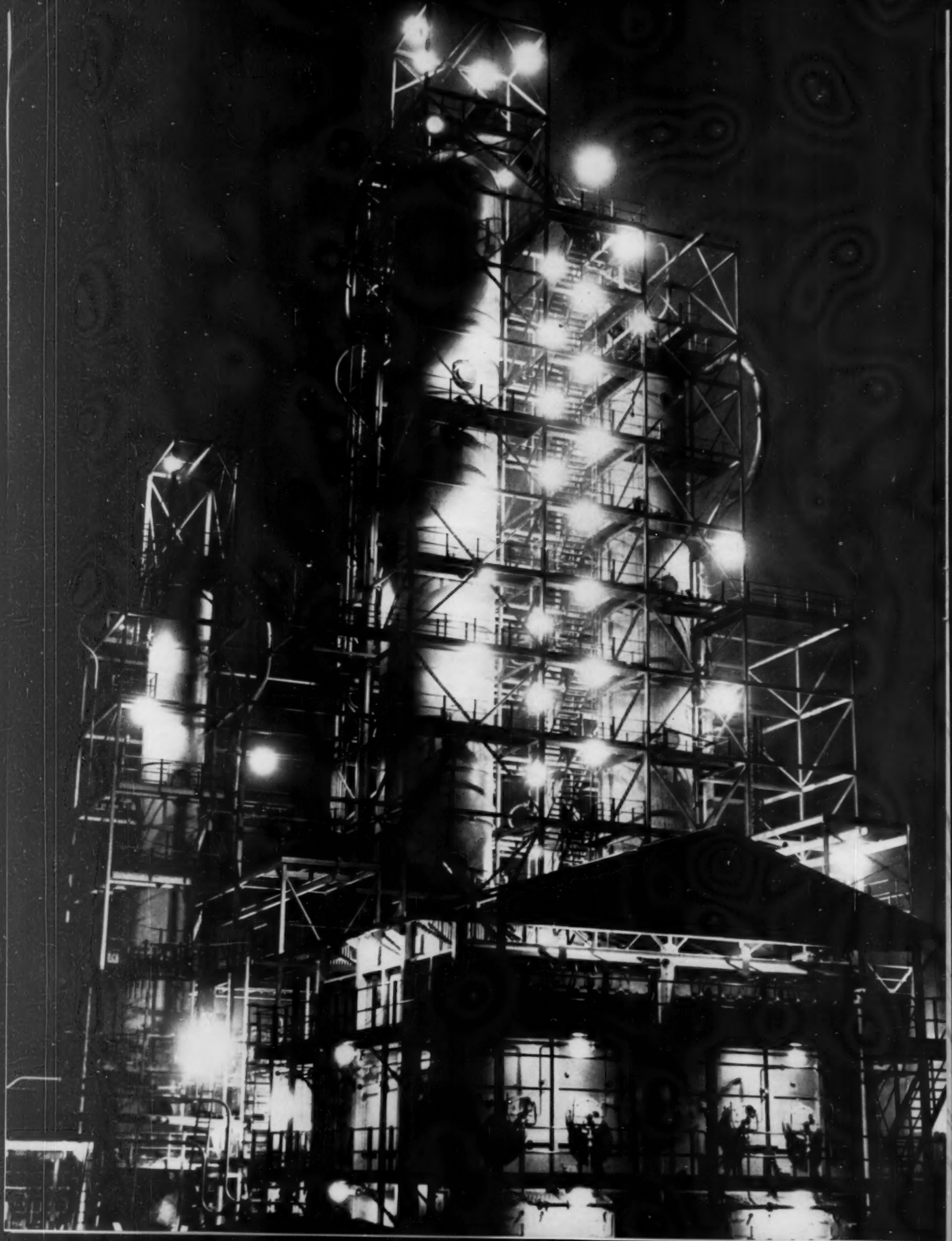
Another firm, Nippon Mining, plans to set up a plant with a daily refining capacity of 20,000 barrels to produce methanol.

Thus, the petroleum industry, bombed almost to a cinder in the Pacific war, shows that its resourcefulness is by no means dead. In 1954, with problems of import, coal rivalry, foreign allocation and disputed sources, the industry is going ahead to carve out a future for itself in the East.

Solvent extraction unit at Kudamatsu refinery of Nippon Petroleum Refinery Co. Ltd.



Tank cars of the type used on Japanese railways.



ANNUAL CAPACITY OF THE WEST GERMAN CRACKING AND REFORMING PLANTS
As at 31st December, 1953 — in 1,000 metric tons.

	Catalytic Cracking	Thermal Cracking	Catalytic Reforming	Thermal Reforming	Hydrogenation
BP	—	210	—	150	—
DEA	360	—	—	—	—
Deurag-Nerag	—	210	—	100	—
Esso	450	—	—	165	—
Gelsenberg	450	—	—	—	500
Ruhrbau	—	20	—	—	—
Ruhrchemie	—	140	70	—	—
Ruhroel	—	—	—	40	—
Scholven	240	—	—	—	240
Vacuum	360	—	—	—	—
Wesseling	—	550	—	220	330
	1,860	1,130	70	675	1,070

Facing page: newly erected distillation unit at the BP (Anglo-Iranian) refinery at Hamburg-Finkenwerder.

GERMAN refining industry sets record of major progress

By Alfred M. Stahmer

THE PAST YEAR has been one of great progress in the refining industry of Western Germany. Completion of major undertakings such as those of Esso Standard and Deutsche Shell at Hamburg-Harburg; BP (Anglo-Iranian) at Hamburg - Finkenwerder; Gewerkschaft - Erdoel-Raffinerie Emsland at Lingen-Holthausen; the catalytic cracking plants of DEA, Heide, and Deutsche Vacuum, Bremen-Oslebshausen; and, last but not least, the reactivation of the hydrogenation works of Gelsenberg, Wesseling and Scholven and their equipment with major distillation and cracking capacities have been milestones in the process of rebuilding the war-damaged refining industry and increasing crude oil treating capacity according to the requirements of the country. In 1948 about 82 percent of the total German oil imports still consisted of finished products. In 1953 product imports had sunk to 13 percent. They are practically restricted to the seasonal top demand for gas oil, to deliveries of domestic fuel, brightstock, aviation gasoline, and minor quantities of some special products.

The annual crude intake capacity of the refineries in Western Germany, which at the end of 1952 amounted to 8,135,000 tons, in the course of 1953 was stepped up to 9,780,000 tons. This figure does not include the newly erected plant of GER at Lingen-Holthausen with an annual crude throughput of 500,000 tons and the enlarging of BP, Hamburg-Finkenwerder, by which a distillation capacity of 580,000 tons annually has been added to this plant.

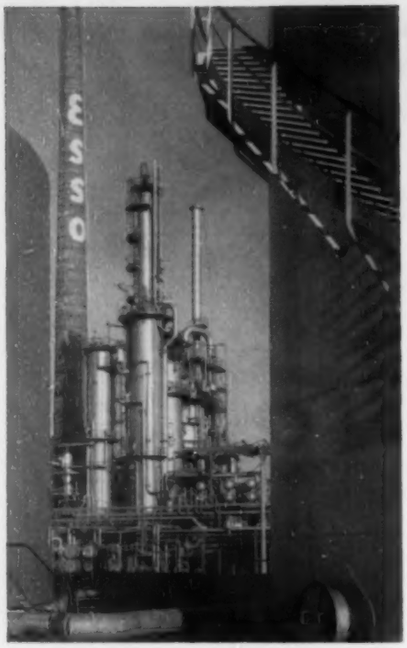
Chief factor in the yearly refining capacity is the new Esso plant at Hamburg-Harburg, which began work at the beginning of the year and was formally dedicated at the end of April. This is now one of the largest and most advanced oil refining works in central Europe.

On a site adjacent to its old refinery, Esso erected a primary fractionating unit, a reforming unit for the thermal cracking of heavy gasoline recovered by distillation and a catalytic cracking plant. Thus the former annual crude intake capacity of Esso, Harburg, of 700,000 tons was increased to 1.84 million tons. Aramco crude is processed in the new refining section, only the distillation residues without the bitumen content being put through the cat cracker. In the older section of the plant, Tia Juana crude from Venezuela is processed for bitumen as formerly. The motor spirit produced at Harburg by mixing topping and cracking gasoline possesses a standard quality of about 79 octane (motor method) at a lead addition of 0.03 percent. For the current year, a total intake of 1,355,000 tons of Aramco and 370,000 tons of Tia Juana crude has been planned.

The relatively small increase of the crude intake capacities at some other refineries is explainable either by their switching over to other processing methods or by the addition of new cracking facilities. Some of those mentioned in last year's report have since been put on stream at the refinery of Deutsche Vacuum Oel AG. at Bremen-Oslebshausen and at the hydrogenation works at Gelsenberg and Wesseling. The Thermofor catalytic cracking plant of Gelsenberg Benzin AG went into operation in August last. It is of the Socony-Vacuum type, operating with aluminum silicate

ANNUAL INTAKE CAPACITY OF WEST GERMAN PLANTS PRODUCING LUBRICATING OIL
As at 31st December, 1953 — in 1,000 metric tons.

BASF, Ludwigshafen	10
DEA, Hamburg-Grasbrook	75
Deurag-Nerag, Misburg	75
Esso, Hamburg-Harburg	74
Gasolin, Dollbergen	37
Shell, Hamburg-Harburg	76
Shell, Monheim	60
Schindler, Hamburg-Neuhof	23
Vacuum, Bremen-Oslebshausen a.Wedel	50
Wintershall, Salzbergen	20
	500



Fluid cat cracker at the Esso refinery at Hamburg-Harburg.

contact at an annual intake of about 500,000 tons of distillates, semi-finished products or crude oil. Gelsenberg also erected a polymerization unit to which at present a UOP Platformer is being added. In the polymerization unit, from the unsaturated hydrocarbons of the cracking gases obtained in the cat cracker (proportion about 40 percent), polymer gasoline is produced which is used as an admixture to the motor fuel yielded by the combination of cracking and hydrogenation. The separation of cracking gases and the production of LPGas is carried out in a new plant adjoining an older unit for processing hydrogenation gases.

Endeavors are being made at Gelsenberg to achieve the highest possible output of diesel fuel which is in very great demand in Germany. During the first half of 1953, diesel oil accounted for 35-40 percent of Gelsenberg's total output. The refinery's total crude intake capacity of 1.3 million tons per annum can be increased to 1.8 million tons if other operating methods are applied.

At the hydrogenation works of Union Rheinische Braunkohlen Kraftstoff AG., Wesseling near Cologne, a thermal cracking plant with a system of separate oven batteries for cracking heavy and light oil respectively was put into operation early in 1953. Combined with this cracker is a thermal reforming unit where heavy gasolines from the distillation unit are turned into motor spirit with an octane number of 70-72 (motor method) unleaded. In order to reduce the gum and sulfur contents, the cracking and reforming gasoline is catalytically refined. For this procedure hydrogenous waste gases from the hydrogenation works are used at pressures of 20-40 atmospheres.

In a polymerization plant which has been put on stream at Wesseling, the unsaturated C_3 and C_4 hydrocarbons are turned into polymer gasoline with a high octane rate. The existing Claus plant for the production of elementary sulfur from the hydrogen sulfide of the waste gases from hydrogenation was enlarged so that the hydrogen sulfide of the cracking gases can now be processed.

The combination of cracking and hydrogenation enables Wesseling to reach a 90 percent yield of liquid motor fuels including LPGas. When cracking residues with a high content of aromatics are hydrogenated, the pure hydrogenation gasoline after addition of 0.04 vol. percent tetra-ethyl lead has an octane number of 84 (motor method).

Apart from some smaller plants in the Ruhr district, the refinery of Gewerkschaft Erdoel-Raffinerie Emsland at Lingen-Holthausen is the only one erected since the war on a site where oil never before was treated. Wintershall AG. and Gewerkschaft Elwerath, which share 65 and 35 percent respectively in GER, built the refinery to have processing facilities for the bulk of the ever-growing crude oil production in the Emsland district. The annual intake capacity of the refinery is 500,000 tons, but can be stepped up to 600,000 tons if necessary.

About $18 million was spent on the erection of the Houdry cracking unit and the supplementary plants at Lingen. In August 1953, the cat cracker was completed, but unfortunately was damaged at the start of operation involving re-erection of a section of the cracking tower. This work was completed in time to begin operation early in 1954.

In the new refinery, crude from the Emsland fields yields an output of about 48 percent of gasoline, 14 percent of diesel fuel, seven percent of liquid gas, 11 percent of petroleum coke, six percent of fuel oil, and seven percent of coke residue. Losses amount to one percent. The catalytic cracking method had been chosen for the plant, as the heavy Emsland crudes with their natural content of about seven percent of gasoline and about 18 percent of diesel oil are unsuited for the production of lubricating oil. By their very low sulfur content, the crudes are specially adapted to the production of petroleum coke.

The Houdry cat cracker at Lingen has been supplemented by a polymerization unit where liquid phosphoric acid is applied on a quartz bed. The pure cracking gasoline has an octane number of 78-80 (research method), the polymerization gasoline of more than 96 (research method). After mixing both and adding a very small percentage of lead, the refinery is able to produce motor gasoline meeting all requirements.

In July the new Platforming unit of the refinery of BP Benzin und Petroleum GmbH. (Anglo-Iranian) at Hamburg-Finkenwerder, the first of its kind in continental Europe, is to start operations. As early as the beginning of this year, BP added a Foster Wheeler distillation unit with an annual crude oil input of 580,000 tons, thus enlarging its total capacity to 1.3 million tons *per annum*. The UOP Platformer will refine about 250,000 tons of heavy distillate gasoline annually to give motor fuel with an octane rating of 89 to 91 (motor method). The heavy gasoline is heated to 900°F. and then flows over a fixed bed platinum reactor at an operating pressure of 650 to 700 psi depending upon the properties of the base material and the required octane number. In the presence of the catalyst, the naphthenes of the heavy gasoline are dehydrated to aromatics. At the same time BP is erecting a continuously-working bitumen blowing plant intended for

Platforming unit under construction by Anglo-Iranian at Hamburg-Finkenwerder.

a production of 50,000 tons of bitumen *per annum*.

Of special interest is a new oil separator to prevent oil pollution of water; a Dorr type of modern construction consisting of a circular water basin, where, at regular intervals, the oil is skimmed off the surface by a revolving arm.

After the new plants have started work, the finished products output recovered in the BP refinery will consist of about 25 percent of motor gasoline, 28 percent of diesel fuel, one percent of LPGas, five percent of bitumen and 40 percent of fuel oil.

Apart from the crude intake capacity of 9.78 million tons annually, German refineries at the beginning of the year had 1.86 million tons of thermal cracking capacity, 70,000 tons of catalytic reforming capacity, 675,000 tons of thermal reforming capacity and 1.07 million tons of hydrogenation capacity. A capacity of 500,000 tons *per annum* is available for refining distillates to give lubricants.

Indigenous crude provided about one third of the crude intake of the refineries in 1953. Of the imported crude, 84 percent came from the Middle East. The cif-value of the crude imports amounted to $99.2 million. Of the foreign crude imported, 53 percent was paid for in dollars and 47 percent in sterling.

With 6.4 million tons of finished products in 1953, the output of the German refineries and hydrogenation works shows a 24 percent increase over the preceding year. The plan of the refineries association (AEV) for 1954 provides for an output of about 8.9 million tons. A certain surplus output of gasoline in 1953 was absorbed by exports (mainly to Denmark) and by deliveries to the occupation forces. After the start of the new cracking, reforming and polymerization plants, the octane number for the average gasoline rose to 80 (research method) at the end of 1953.

By 1955 the annual amount of crude and residues to be cracked in the Federal Republic is to rise to about five million tons. From this, 300,000-400,000 tons of cracking gases capable of reacting can be recovered. What are the chances of these gases being used as base material for petrochemistry?

Although some widely adopted synthesis methods originated in Germany, it appears that lack of funds may delay the further development of a German petrochemical industry. Since the war the mineral oil industry has invested more than $180 million in new refining plants. This is a heavy drain on an industry which cannot accumulate capital because of high taxation. Furthermore, Germany already possesses a chemical industry of long standing based originally on coal.

The mineral oil companies appear to have chosen the course of co-operating with the chemical industry which has grown organically in the past. For example, in September last, Deutsche Shell AG. and Badische Anilin- & Soda-Fabrik AG. jointly established the Reinische Olefinwerke at Wesseling in which each owns a 50 percent interest, the capital amounting to 16 million DM. ($4,000,000). The foundation of this enterprise may well be regarded as the beginning of large scale petrochemistry in Germany. In a factory to be erected near Wesseling on the Rhine, Rheinische Olefinwerke intend to produce Lupolene (registered trade mark for polyethylene) as well as ethyl benzene from refinery gases supplied by the neighboring hydrogenation and cracking plant of Wesseling. Operations are to be started in 1955. The polyethylene demand of the German market is estimated at 10,000-14,000 tons *per annum*.

A second petrochemical project on a larger scale is the plant of Phenolchemie GmbH. at Gladbeck-Zweckel (a joint interest of Scholven-Chemie AG. and Ruetgerswerke AG.) which is to take up operations this year. Zweckel will receive cracking gases from the hydrogenation works of Scholven from which propylene will be processed to give phenol and acetone.

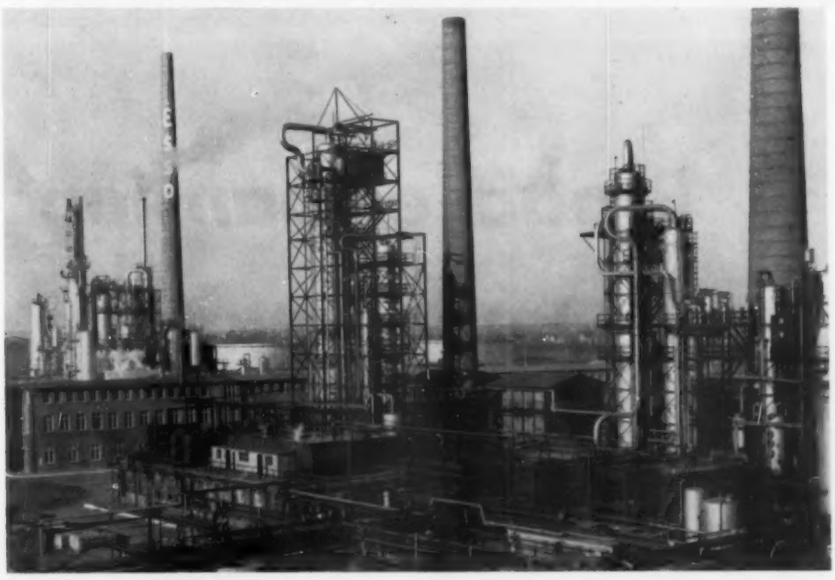
Pioneers of petrochemistry in Germany are Chemische Werke Rheinpreussen which, even before the Second World War, had erected synthesis plants at Homberg and Meerbeck (Lower Rhine). Today Chemische Werke Rheinpreussen uses as its raw material olefins from the oil refineries of Hanover and Hamburg and also from the hydrogenation works of Wesseling. At Meerbeck, olefins are refined to give isopropyl and butyl alcohol as well as methyl ketone. In a special section of the plants, aromatic hydrocarbons, such as benzene, are alkylated by aliphatic hydrocarbons of a definite composition. The products resulting are sulfonated and then used as raw material for the production of detergents.

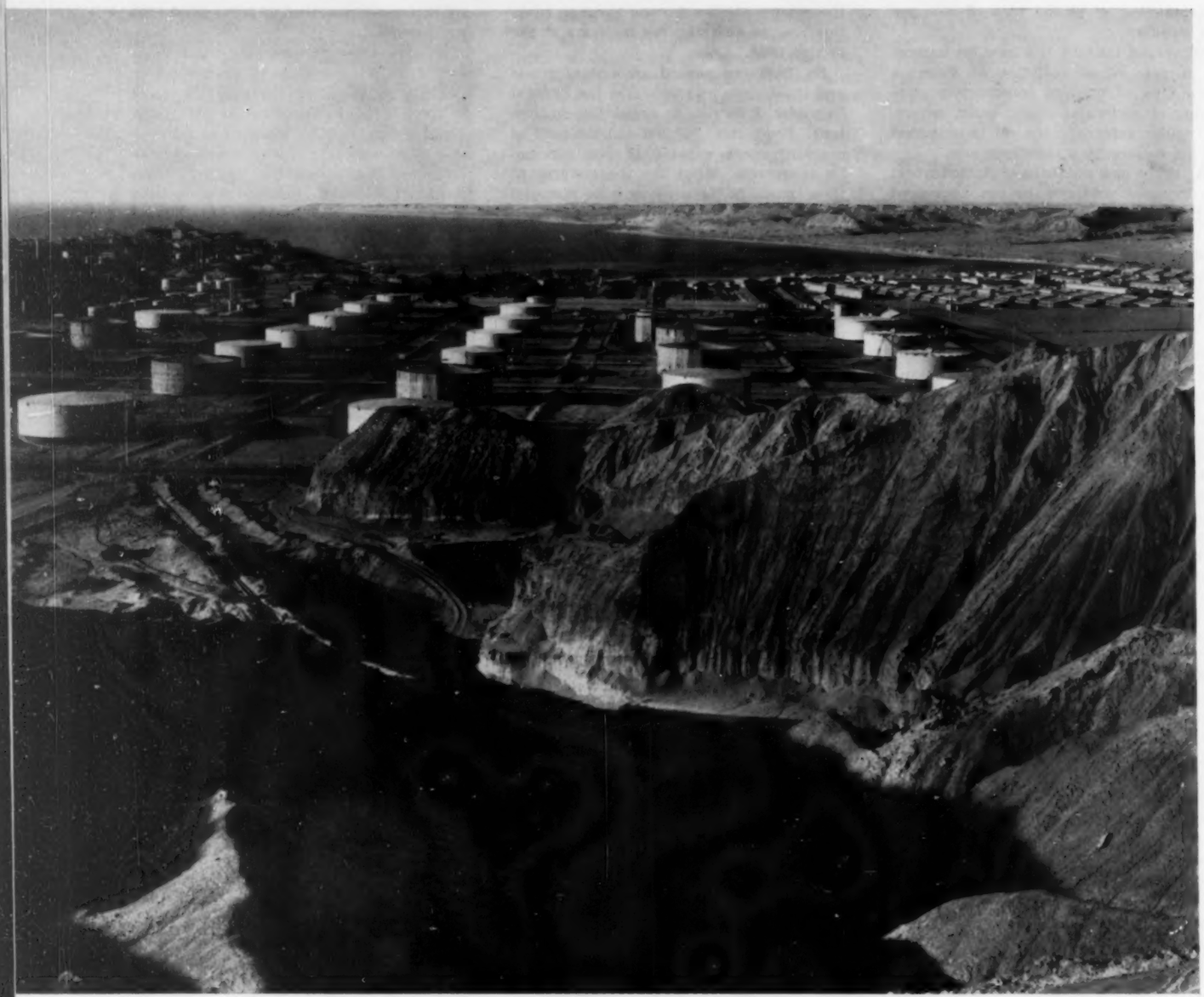
The Chemische Werke Huels near Marl have been pioneers in the field of petrochemistry. By the electric arc method, it processes natural gas from Bentheim and gases from hydrogenation plants to produce plastics and other synthetic products.

Not only the Badische Anilin- & Soda-Fabrik, but also the two other successors of IG-Farben, viz. Farbwerke Hoechst and Farben-Fabriken Bayer, Leverkusen, apparently intend to enter the field of petrochemistry. Last fall Farbwerke Hoechst AG. and Vereinigte Glanzstoff-Fabriken AG. together acquired from Imperial Chemical Industries Ltd., London, the exclusive license for the production of terylene in Germany. A 25-mile pipe line was laid from DEA's newly discovered gas field Pfungstadt in the Upper Rhine valley to Hoechst, and some weeks ago the first natural gas was piped from Pfungstadt to Hoechst. Four to five million cubic meters annually are to be supplied to Hoechst. The natural gas will serve as base material for the production of terylene.

In May 1953, Farbenfabriken Bayer acquired a 50 percent interest in the firm of Ruhrbau GmbH. which, after the war, had erected an oil refinery at Muelheim. It was generally expected that the Ruhrbau refinery, which until then had been restricted to topping, would be enlarged by the addition of a chemical plant for the treatment of residues. In the Spring of 1954, however, in view of the severe competition and small proceeds from the sale of topped fuels in the German market, Ruhrbau GmbH. decided to discontinue crude processing until further notice. This does not mean that plans for the erection of a petrochemical plant at Muelheim have been abandoned.

General view of Esso's Hamburg-Harburg plant.





Partial view of International Petroleum Co. refinery, Talara, Peru. Photo Courtesy Standard Oil Co. (N.J.).

Broad expansion under way in Latin American refining

RAPID EXPANSION of refining capacity is under way in several South American countries. Venezuela, of course, is still far in the lead as befits its position as the foremost producing area of the Western Hemisphere aside from the United States. As a result of the great construction program of the past five years, the country's processing plants, together with those of nearby Netherlands West Indies, which are fed by Venezuelan crude, are operating on a throughput of well over a million barrels daily. Venezuela's refining situation and current developments are discussed in a separate article on other pages of this issue.

Other South American countries, however, are enlarging their plants or adding new ones, either to handle growing production or because they have adopted a policy of establishing manufacturing facilities within their own borders and importing crude rather than products.

Brazil is an outstanding example in the latter category. While indigenous production supplies only a tiny fraction of the country's rising petroleum requirements, the government has entered upon a program of refinery development designed to effect a saving in its annual outlay for oil imports amounting to upward of $200 million yearly by substituting crude for product imports and thereby relieving the foreign exchange position to some extent.

Newest and most conspicuous exhibit in this program is the 45,000 b/d refinery at Cubatao, near the port of Santos, designed and installed by Hydrocarbon Research Inc., which is approaching completion. Its topping unit, with an initial capacity of 20,000 to 25,000 barrels, is about ready to start operating. The plant represents an estimated investment of $60 million.

In March 1953, a project was approved to raise the capacity of the Cubatao plant to 75,000 b/d in order to meet the requirements of the geographic region served through the port of Santos. This region, the most highly industrialized in Brazil, embraces the state of Sao Paulo, southern Minas Geraes, the Minas Geraes triangle and South Goias. It contains nearly one quarter of Brazil's population and more than one third of the total number of motor vehicles in service in the country.

To provide a crude supply for the refinery during the next five years, contracts were placed with Esso Export Corp. to supply 30,000 b/d of Recon type crude and with California Transport Corp. to supply 15,000 b/d of stabilized Arabian. The buyer has the option of increasing these quantities to 45,000 and 20,000 b/d respectively.

A special commission was appointed in 1953 to install plant for manufacturing nitrogenous fertilizers at Cubatao, using the refinery's residual gases. The necessary equipment is being supplied by American, French and German firms. The plant is designed to consume daily 100,000 cubic meters of gas and to produce 100 tons of anhydrous ammonia, 200 tons of fertilizer and 30 cubic meters of hydrogen per day.

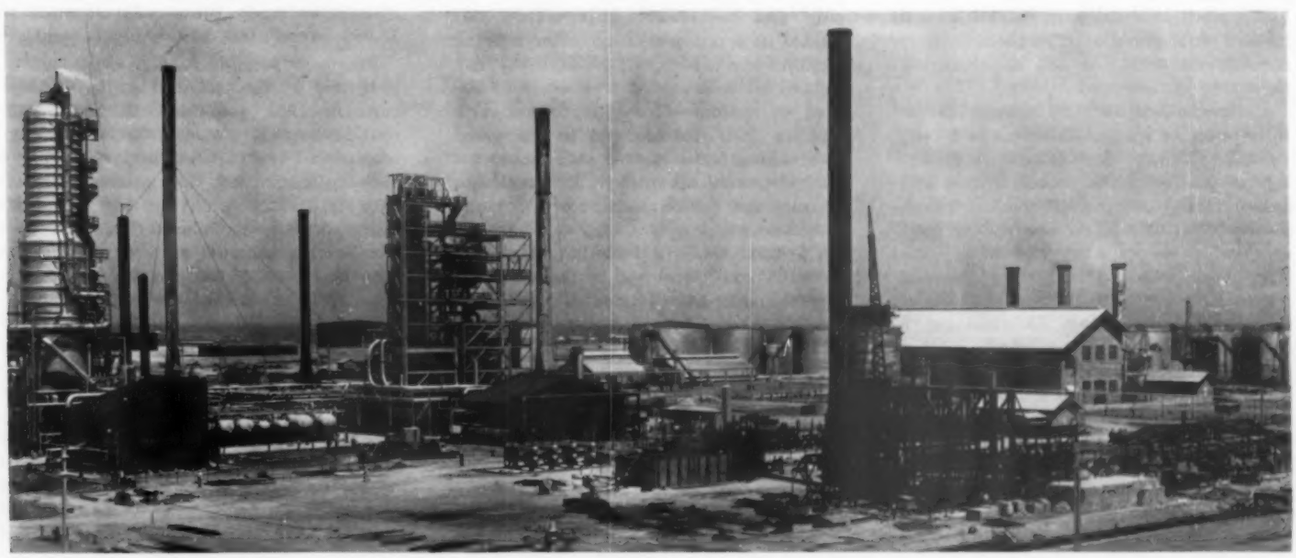
The capacity of the Mataripe refinery, designed and installed by M. W. Kellogg Co. to process the output of Bahia fields, was raised to 5,000 b/d and the catalytic polymerization unit began operating last year. A new project aims at increasing refining capacity of 15,000 b/d and producing 3,000 b/d of lubricants. The plant was originally designed to process 2,500 barrels of crude from the Candeias and Itaparica fields, capacity being based on their proven reserves at that time. Last year, when the Dom Joao field began producing, it was connected by pipe to Candeias and supplemented the supply from the latter to Mataripe. Another duct, 80 kilometers long, is to be laid to convey crude from the recently discovered Agua Grande and Mata de Sao Joao fields. Bahia wells yielded 851,182 barrels of oil in 1953.

Refinaria e Exploracao de Petroleo S.A. (Uniao) has completed preparation of the site, water and power systems at Capuava, Sao Paulo. Buildings, piping, erection of TCC unit, tanks and other facilities are well advanced. The greater part of the equipment ordered in the United States has been received and all work should be completed by November next. About 100 American firms are participating in the construction and supply of materials to this 20,000-barrel refinery, which was planned and is being installed by Hydrocarbon Research Inc. The Thermofor catalytic cracking process with catalytic polymerization has been adopted and the plant will work on Kuwait crude to be supplied by Gulf Oil Corp. The crude will be discharged at Santos directly to the Santos-Cubatao pipe line and conveyed to Capuava, a distance of 21 miles, by 12-inch pipes. Branch lines of 8- and 14-inches between the refinery and the Utinga terminal will carry refined products to Sao Paulo.

Refinaria de Petroleo de Manguinhos, S.A., which doubled its capital last year, is well advanced with construction and installation work on its 10,000-barrel refinery. In accordance with the new petroleum law, the Manguinhos and Uniao refineries must be completed within the period ending December 31, 1954.

Companhia de Petroleo da Amazonia S/A is concessionaire of a 2,500 b/d refinery at Manaos. The company has been

Pipe still and stabilization plant under construction at Amuay Bay refinery of Creole Petroleum Corp.



Construction under way at Barrancabermeja, Colombia. Steam generating plant in foreground, process units in background. Progress photo courtesy Foster Wheeler Corp.

awarded the exclusive right to import oil from the Aguas Calientes region of Peru and distribute it in Brazil. It must begin operation by the end of 1955.

Other refining projects are under consideration, but without final determination. The government meanwhile has decided to delay for the present the proposed establishment of a shale oil distillation plant at Paraiba in Sao Paulo and instead will erect a pilot plant with a capacity of 500 b/d for experimental tests.

Extensive additions to refining facilities are under way in Colombia. An outstanding project which is now approaching completion is the modernization and enlargement of the Barrancabermeja plant, which was taken over by the government at the expiration of the concession under which it had been operated for many years by private capital. It is now held by Empresa Colombiana, a state company, and is operated under a management contract by International Petroleum (Colombia) Ltd. The remodelling and enlargement of the plant is being directed by the well-known engineering firm of Foster Wheeler.

The new process units in the Barrancabermeja expansion include a combined topping plant and visbreaker, fluid catalytic cracking plant and vapor recovery section, alkylation plant, acid recovery plant and a gasoline caustic treating plant. The offsite installations consist of a power and steam plant, cooling water system, tankage and miscellaneous facilities.

The first completed unit of the new processing facilities is the combined topping and visbreaker unit which was started up a few weeks ago. The topping section has a capacity of 30,000 b/sd. The visbreaker is designed to process 16,500 b/sd of bottoms from the atmospheric topping unit. In addition to the usual visbreaking features, this unit includes a tar stripper operating at moderate vacuum and a debutanizer tower for unstabilized gasoline.

The fluid catalytic cracking plant is a Model IV unit developed by Standard Oil Development Co. It has a fresh-feed capacity of 15,000 b/sd with provision for 4,000 barrels of heavy recycle for a total combined feed throughput of about 19,000 b/sd.

The vapor recovery plant has a common battery limit and control room with the catalytic cracker. The charge to the vapor recovery section will consist of gas and 400° F. EP gasoline from the catalytic cracking section, besides separator and overhead gas from the visbreaker, together with vent gases from the existing and new topping units. The recovery from this unit will be at least 95 percent of the total C_4 fraction in the charge. In addition, this section is designed to produce LPGas.

The alkylation unit has capacity to produce 1,200 b/sd of 3-4 RVP aviation alkylate of good octane quality. This unit employs sulfuric acid as a catalyst and utilizes the auto-refrigeration system. Completion of this unit is scheduled for July 15.

Capacity of the acid recovery unit is 25 tons per day of 98 percent sulfuric acid. This unit burns spent alkylation acid to form SO_2 and then oxidizes this product to SO_3 over a vanadium catalyst.

The caustic gasoline treating unit has a capacity of 10,000 b/sd to continuously treat a mixture of debutanized gasoline from the vapor recovery plant and from the visbreaker.

Three steam generators and three turbo-generators have been installed in the new steam and power plant and have been placed in operation. Each steam generator has a capacity of 132,000 pounds per hour of 425 psig steam superheated to 740°F. Each generator is rated at 3,500 kilowatts and 2,400 volts.

A crude stabilization and gas plant at Tibu, built for Colombian Petroleum Co. (Socony-Texas) by Fluor Corp. at a cost of $8 million, was completed at the end of 1953. The topping unit has a capacity of 2,200 b/d. Texas Petroleum Co. has built a plant of 1,000 b/d capacity at Guamo for its Tetuan field in the department of Tolima.

A refinery planned for erection at a site near Cartagena by International Petroleum Co. is to have a reported daily throughput of 25,000 barrels and an estimated cost of $35 million, but is not expected to be completed before 1958. A project that has been urged in some circles, but has not gone beyond the stage of suggestion, is the construction of a 35,000-barrel plant by the government.

Room for possible further expansion is indicated by the fact that while refinery runs in 1953 amounted to nearly 12 million barrels, a considerable quantity of products is still being imported.

Refining in Peru is centered almost entirely in the plant of International Petroleum Co. at Talara. Through successive enlargements, its charging capacity has reached a position where it handles 98 percent of the country's processing. Most recent addition was the construction of a 45,000 b/d atmospheric pipe still and a 4,000 b/d cracked naphtha depropanizer which was started in September last by Arthur G. McKee & Co. The depropanizer was completed and put into operation in April.

The pipe still replaces a battery of shell stills and releases existing thermal coils for topping operations. The depro-

panizer is self-refluxing and operates integrally with existing cracking coils and fractionator to stabilize the total production of cracked naphtha. The tail gases from the depropanizer go to the gas plant.

The only other refineries in Peru are those of Ganso Azul Co. in the Oriente region (1,000 b/d) which distributes its products in the Amazon district of Brazil, and the plant of Empresa Fiscal of 1,300 b/d capacity. This was formerly located at Viller near Zorritos on the northern coast, but has been dismantled and removed to Iquitos, capital of the department of Loreto, on the Amazon, where it is being reconstructed.

A concession for erection of a 2,000-barrel refinery at Pisco, the port of Lima, has been granted to the Helios Co. It is designed for the production of special products such as lubes and paraffin and is scheduled for construction in 1955 with equipment made in Germany.

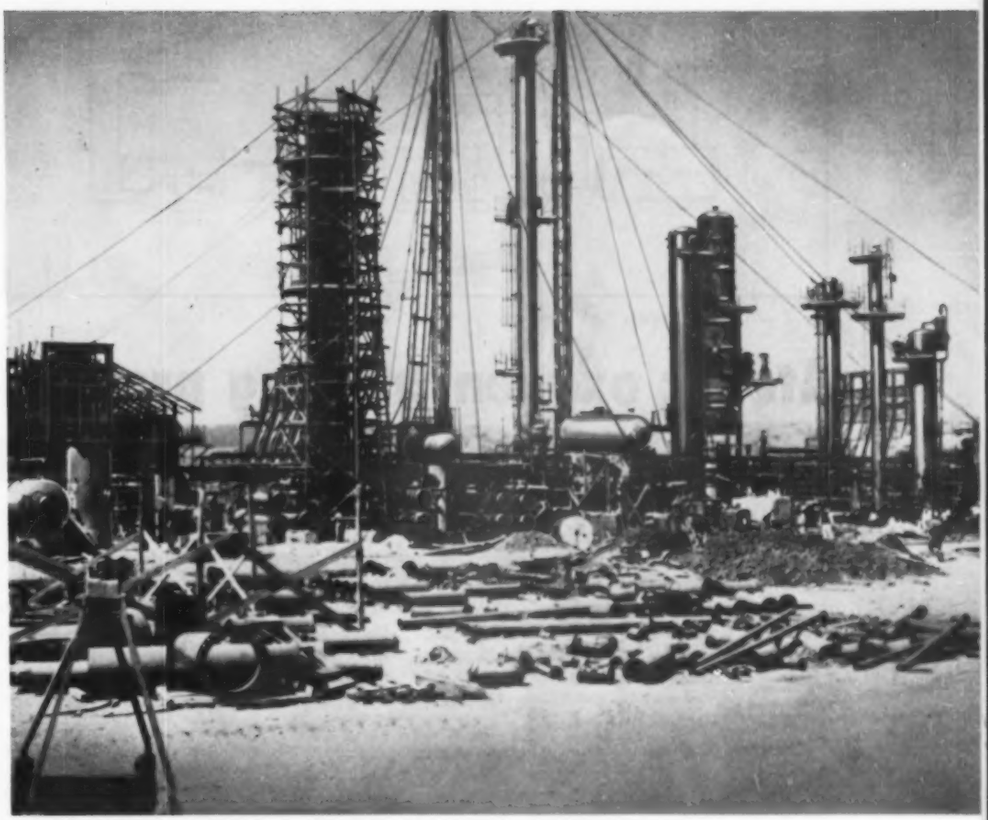
Refinery runs in 1953 amounted to 13,914,828 barrels, of which 11,494,528 barrels of International Petroleum Co. and 2,207,779 barrels of Lobitos Co. were processed in Talara. Ganzo Azul's refinery run amounted to 201,574 barrels and Empresa Fiscal, operating only half of the year, 10,947 barrels. Domestic consumption amounted to about 11 million barrels, including imports of lubes and special products, and International exported 3,601,103 barrels of refined products.

A nation that is ambitious to expand both its production and refining is Argentina, as it is still under the necessity of importing a large proportion of its growing petroleum requirements. Its most important current activity is the enlargement and modernization of the YPF refinery at Puerto Plata, since renamed Eva Peron. The undertaking, designed to raise charging capacity to 113,000 b/d, is under the direction of Kellogg Pan American Corp. and includes the installation of crude stills, a fluid cat cracker, feed preparation unit, delayed coking unit and alkylation unit.

In Buenos Aires, Diadema Argentina S.A. has added a lube unit of 600 b/d capacity to its refinery.

Recent reports from Buenos Aires have told of negotiations between the Argentine government and a group of North American capitalists involving the investment of very large sums in the development of Argentina's oil industry, but no official confirmation has appeared as yet.

In Chile the new national refinery of Empresa Nacional del Petroleo at Concon near Valparaiso is scheduled to go on stream in August of this year. The plant has a charging capacity of 20,000 barrels and includes a thermal cracking unit of 5,000 b/d and a reforming unit of 4,160 b/d. This will be the first complete refinery in Chile. The only plant previously in operation is a topping plant of 500 barrel capacity at Manantiales in the Magellan field, which supplies products for use in the local area.



Chile's first large scale modern refinery under construction near Valparaiso for Empresa Nacional del Petroleo. Progress photo courtesy M. W. Kellogg Co.

Crude oil capacity of Pemex refineries in Mexico now totals 272,000 barrels daily and additional building is contemplated to keep ahead of the growing domestic demand for petroleum products. In 1953, Mexican plants processed 188,000 barrels of crude per day compared with 171,000 b/d in 1952 and 155,000 b/d in 1951. Domestic consumption has been rising at about eight percent annually, and refinery throughput has been stepped up about 10 percent.

A major project under way at the moment is the new lubricants plant at Salamanca which is scheduled for completion in September. Crude capacity of the plant is being increased to 40,000 b/d from a former level of 27,000 b/d. The Salamanca lube plant is expected to fully meet domestic requirements of Mexico for the immediate future. Output will be 2,600 b/d of lubes and 65 tons of wax.

Another major job is the expansion of the Atzcapotzalco refinery by the construction of a new 30,000 b/d distillation unit. An 8,000 b/d cat cracker is a future project. Other facilities to be added will include an alkylation unit.

At Minatitlan it is planned to replace one of the present distillation units, which has a current capacity of 9,000 b/d, with a new 40,000 b/d unit. This will virtually double the present crude capacity which is rated at 32,000 b/d. A TCC unit, cat poly unit and other facilities will be added. A complete new $40 million refinery for heavy Tampico crude is being considered.

Preliminary construction work is under way for the plant of Caribbean Refining Co. at Bayamon, Puerto Rico, north of San Juan. The refinery is engineered by The Fluor Corp. of Los Angeles and will have a capacity of 10,000 b/d. Estimated cost is about $10 million.

Facilities of the refinery will include atmospheric and vacuum distillation units for Venezuelan crude, a UOP fluid catalytic cracker, catalytic polymerization and gas recovery units.

Principal stockholders in the company include Pontiac Refining Corp. of Corpus Christi, Gulf Oil Corp., J. H. Whitney, H. M. Byllesby and Co. and Ferre Industries of Puerto Rico. The Government Development Bank of Puerto Rico was a participant in the financing.

Construction has begun on a refinery to be erected at Guayanilla Bay, Puerto Rico, west of Ponce, by the Commonwealth Oil Refinery Co., Inc. The company

(Continued on page 176)

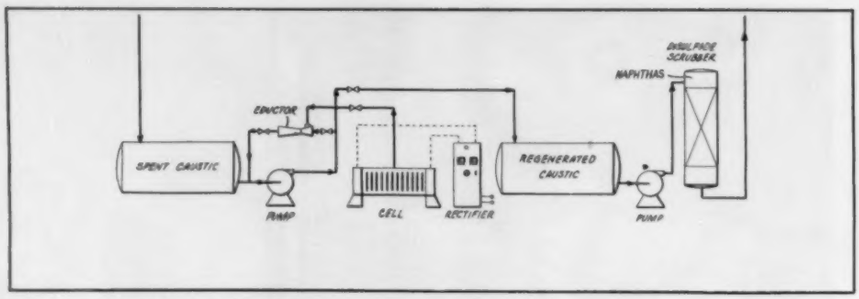


Fig. 1—Electric Process flow diagram.

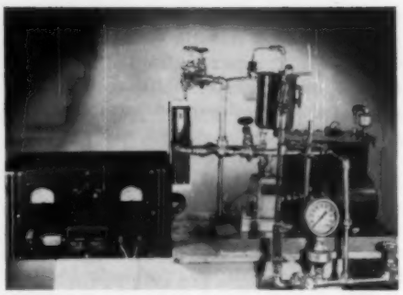


Fig. 2—Pilot plant used in developing Electric Process.

Atomic oxygen treating process solves caustic pollution problem

ASHLAND OIL AND REFINING Company, Ashland, Ky., recently converted one of its gasoline treating plants to employ the Electric Process, a newly developed method of caustic regeneration. The process is designed to eliminate possible stream pollution by permitting the treatment of millions of barrels of gasoline with a stock of caustic limited to a few hundred barrels.

Heart of the Electric Process is an electrolytic cell which produces atomic oxygen for the elimination of sulfur compounds from spent caustic. Atomic oxygen from the cell contacts the spent caustic through an eductor. Time lag between oxygen generation and contact with spent caustic is held to a minimum of about one minute to ensure oxygen activity.

Figure 1 is a flow diagram of the process which illustrates the simplicity of the equipment required. This is further shown in Fig. 2, a pilot plant in which the inventors, Charles W. Rippie and Howard B. Bishop, carried on some of their development work.

In the pilot plant operation the spent caustic solution is pumped under pressure with atomic oxygen produced in a separate external electric cell. Only the gaseous atomic oxygen is taken from the electric cell so that the most efficient conditions of producing atomic oxygen can be maintained. The apparent advantages are that the alkaline electrolyte is kept in a high state of purity at all times since only water is added as makeup to the cell. The proper concentration of electrolyte can thus be readily maintained at the optimum temperature for efficient production of atomic oxygen. Under similar operating conditions, such electric cells have operated for several years with minimum maintenance in the production of gases for industrial use. The tank type cell operates under a very low pressure so that regulating instruments assure uniform plant operation for extended periods of time.

The Electric Process oxidizes sodium sulfide-sulfur in the foul caustic soda solution. The hydrogen sulfide and mercaptan sulfur compounds are converted to water-insoluble products. The removal of the water insoluble sulfur oils takes place in both the regenerative caustic tank and extraction in the naphtha washing tower. The regenerated caustic soda solution is re-cycled again to the extracting towers.

It is possible to use the best concentration of treating solution in the extracting section of the plant because the cell operates on an alkaline solution, which is kept separate at all times. The recovered sulfur oils can be utilized for their fuel value or burned for their sulfur recovery in the usual sulfuric acid plant.

The process has treated more than 100,000 barrels of gasoline containing both hydrogen sulfide and mercaptan sulfur compounds with an electric power cost of 50 cents per 1,000 barrels of gasoline treated.

Following is a summary of plant data at the first commercial installation: 8,500 barrels of gasoline treated daily with 1,500 barrels of 20 Baumé caustic solution. Two hundred pounds of H_2S and 80 pounds of RSH extracted and oxidized with 432 KW power applied to the electric cell. The regenerated caustic solution contained from one 3/100 percent H_2S and two to 6/100 percent RSH, four percent acid oils and 25/100 percent of soluble sulfur compounds. Caustic consumption was reduced more than 90 percent compared to steam caustic regeneration.

Tests of regenerated caustic after the extended run revealed only 0.25 percent total sulfur. It is found that no caustic is consumed in the process.

Treated gasoline has been found to require less inhibitor than was required previously when a caustic steam regenerative process was employed.

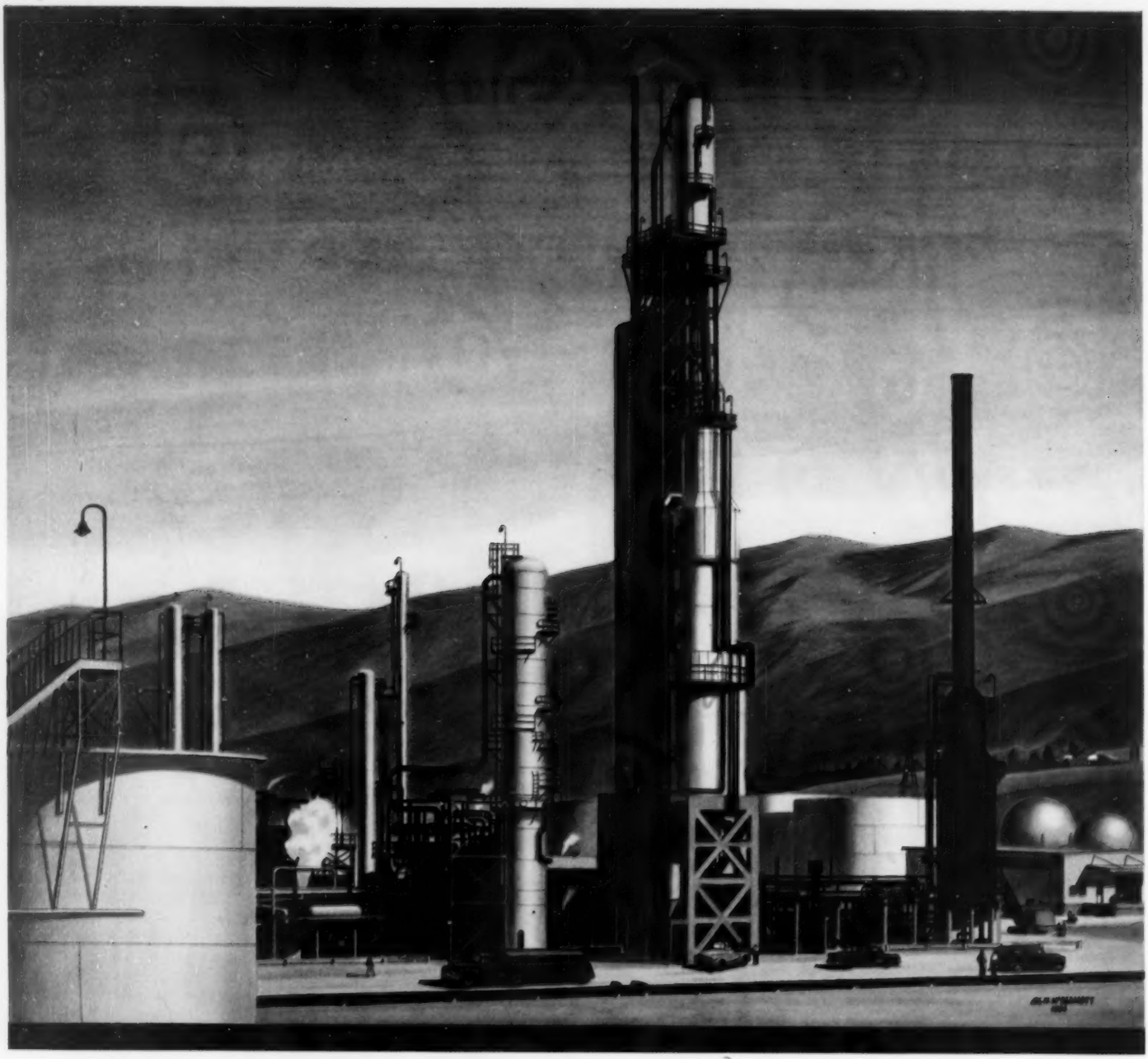
Waste disposal aspects of the process are stressed by the inventors who point to the current development of stronger state and federal controls of water pollution.

Most of the present 150,000 tons annually of caustic soda used in the refining industry is consumed in the treatment of sulfur compounds. The increasing amounts of high-sulfur crude oils as well as catalytic cracking operations produce large amounts of hydrogen sulfide and mercaptan sulfur compounds. Although the amine or phosphate regenerative processes are quite widely used, a considerable tonnage of hydrogen sulfide is removed subsequent to these regenerative processes. The disposal of such large amounts of waste caustic solutions containing sulfide sulfur is an increasing problem in many refineries because of the requirements of many state pollution regulations.

Spent sulfide caustic soda solution requires large volumes of fresh water to supply the chemical oxygen demands because 32 pounds of sulfide consumes the dissolved oxygen in more than 20,000 barrels of average stream water. Oil refineries have blown such alkaline solutions with air, with or without catalysts, in order to reduce the chemical oxygen demand of these solutions when they are disposed in various water bodies. However, air blowing of such spent caustic solutions does not regenerate any free caustic soda for subsequent use, so that no saving in chemical expense is realized. Atomic oxygen produced in the Electric Process regenerates the caustic soda solution and thereby saves the chemical cost of new materials and in addition, the disposal of the spent caustic solution is practically eliminated.

Installation cost of the process is not expensive. Electrical equipment for a plant capable of treating 10,000 barrels of gasoline daily is estimated to cost about $20,000. A 20,000-barrel plant would cost $30,000 exclusive of storage and pumping facilities. Payout time is reported to be less than one year on the basis of current commercial experience. Several units now are in course of construction. An early completion will be at the Cyril, Okla. refinery of Anderson Prichard Oil Corp.

It lighted
our lamps
it
now powers
the world
From first
experiments in 1913 to
worldwide service in
Schlumberger 1954
Developments have Kept
pace with the oil
industry
RUBBER
DETERGENTS
PLASTICS
SOLVENTS



SALT LAKE REFINERY

The Houdriflow Catalytic Cracking Unit of the Salt Lake Refining Company has been consistently handling charge rates well above the 13,000 BPSD design reactor charge rate since going on stream in 1950. In 1952 this installation served as a test unit for studies in catalyst travel. Radioactive beads were introduced into the reactor, and their subsequent movements were checked by Geiger counters. These tests proved that the catalyst circulated through all parts of the Houdriflow unit with excellent uniformity.

Houdriflow units are now operating at the highest conversion levels ever achieved in the industry. An informative new brochure describing the Houdriflow process is available on request. Write to: Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa. International licensor: World Commerce Corporation, S. A.

HOUDRY

PROCESS CORPORATION

Pioneer in Catalytic Processes

Refinery Waste Disposal

(Continued from page 81)

view of the potentially serious corrosive effects of the increasing sulfur content of fuels used today, this improved analytical method serves as a guide in determining the minimum allowable airheater temperature for a given fuel and method of firing.

3. Hydrogen sulfide removal. This toxic gas usually is found admixed with the petroleum vapors and fixed gases resulting from distillation operations. An acidic gas, it can be removed by scrubbing with alkaline solutions, burning, or oxidation by thioarsenate solutions in a cyclic process to elemental sulfur.

A new detection instrument developed by E. B. Offutt and L. V. Sorg, of the Standard Oil Company of Indiana, should further aid in the control of hydrogen sulfide gas. A sample from the air under test is pumped continuously through an exposure hood where the hydrogen sulfide reacts with a chemically treated film to form a stain. A light beam focused on the film strikes a photo-electric cell which generates a photoelectric current. Capable of operating in the range from 0 to 100 ppm of hydrogen sulfide in the air, the machine sounds an alarm when the concentration exceeds the safe limit of 20 ppm.

4. Boiler house smoke control facilities. At the Baltimore Esso Standard Oil Company refinery, recorders and indicators installed on boilers ring a bell and flash a light which warns when the smoke density approaches a value of two on the Ringleman chart. This warning permits operators to correct furnace conditions immediately.

5. Flare control. Esso's Baltimore refinery also has minimized soot and black smoke emission by injection of steam into the main refinery flare. The steam line is inserted into the flare about three feet from the top. Injection of half a pound of steam per pound of gas has been successful in eliminating "trailing" smoke.

6. Asphalt fume disposal. In the preparation of certain grades of asphalt, particularly those used in home roofing, a very hard brittle material is produced by blowing air through the hot liquid asphalt. As air leaves the hot asphalt, it entrains oxidized gases and malodorous vapors. Release of these odorous materials to the air is objectionable and irritating to the nose and throat. Spray chambers through which the spent air passes counter-current to a water spray reduce these fumes considerably, but they have not proven entirely effective. Several domestic refineries have reduced odor emission from oxidized asphalt fumes still further by the installation of fume furnaces in which the vapors are subjected to high temperature oxidation.

7. Control of fluid cat-cracker dust. C. A. Siebort, Jr., and D. L. Cleveland recently described a method employed at Shell Oil Company's Wilmington, California refinery to keep stack losses from the fluid cat-cracker below the 40 pounds per hour limit imposed by Los Angeles County. Catalyst fines removed in the Cottrell precipitator are withdrawn and discarded from the system continuously instead of being returned to the regenerator. This procedure reduces the recycle of catalyst fines through the cyclones and precipitators and increases the recovery efficiency of this equipment to the point where stack losses have been cut from 100 pounds per hour to less than 40 pounds per hour. There have been no adverse effects on the plant operation attributable to the removal of catalyst fines.

8. Catalytic oxidation of refinery waste gases. With fuel consumption amounting to 7-8 percent of the crude processed, it is evident that combustion control is an important factor in air pollution. Combustible materials present in industrial waste gases are sometimes objectionable, and in addition represent considerable heat loss.

Houdry Process Corporation is handling the refinery applications of a new method of recovering heat and eliminating air pollutants from waste gases. This method employs the Oxycat combustion catalyst developed by Eugene J. Houdry, inventor of catalytic cracking. The new combustion catalyst consists of a platinum-alumina alloy coated on porcelain rods which are mounted in brick-like elements. These elements are installed in a bed within the boiler through which the waste gases are passed. The heat in the gases after passage through the catalyst is recovered as steam by means of water cooled coils in the gas stream.

When the heat demand is in excess of the potential waste heat available in the flue gases, injection of the gases into a fuel-fired furnace and boiler of conventional design has been found practical.

Several Oxycat installations in operations for over a year at Sun Oil Company's refineries are effecting fuel savings estimated at $100,000 per year. Rough calculations indicate that wide adoption of this technique in the petroleum industry could result in heat recovery from unburned carbon monoxide and the sensible heat from flue gases equivalent to at least 10,000,000 barrels of fuel oil per year.

Sinclair Refining Company recently described a method which it has developed for the purpose of recovering heat through the burning of carbon monoxide from cat cracker flue gases. At its Houston, Texas, refinery Sinclair has installed a CO boiler and steam superheater which produces over 300,000 lb/hr of 700 psig saturated steam. Supplementary fuel is used to burn the CO to CO_2.

Turning from air contamination to a consideration of stream pollution, a recent study at the Bayway, N.J., refinery of Esso Standard Oil Company describes the planning execution of a refinery waste-stream survey. The overall evaluation of a total waste effluent and its major component flows was adopted as the most practical method of determining the relation and effects of the different sources of contamination.

The Bayway refinery operations currently include the processing of crude oil for the production of gasoline, kerosine, heating oils, and bunker fuel; and the manufacture of chemical products including white oils, alcohol and lubricating additives. From 200 to 300 million gallons per day of salt water are used for normal processing and cooling purposes on a once-through basis, after which they are returned to the waterway from which the flow originated. In addition, approximately three million gallons per day of fresh water for potable and process purposes are discharged to the refinery sewer systems along with the salt water. To determine the origin, concentration, and volume of contaminants as released to the refinery sewer system, a preliminary estimate was prepared of the number of locations in the refinery which would have to be sampled. A study of the refinery sewer map indicated that it would be practical to sample sections of the six major branches of the sewer system. In addition to these samplings, special samples would be required from various operations such as tank-water drawoff, batch release of spent chemicals, water-treating plant sludge blowdown, and others.

The flow from each major processing unit was sampled prior to discharge into the sewer. The final effluent flow from a given group of process units was sampled in order to compare the total contaminants with those in the individual streams, thereby making it possible to determine whether any major contaminant sources had been missed.

Concurrently with the determination of sampling points, a literature survey was conducted to determine which analytical procedures should be employed to evaluate the refinery effluent. One or more of the following tests were conducted to determine the origin and original concentration of contaminants within the refinery: total oil (both volatile and non-volatile), sulfides and mercaptans, phenols, turbidity, dissolved oxygen, biochemical-oxygen demand, and chemical-oxygen demand.

Equipment for obtaining manual-grab-type and automatic-composited samplings was developed for use in the survey. Prior to initiation of sampling in any area, the method of sample collections, analyses, and intended use of the data from effluent evaluations were fully explained to all concerned with execution of the program.

(Continued on page 108)

Refinery Waste Disposal

(Continued from page 107)

Areas within the refinery sewer system were found to require sampling over a continuous 72-hour period to provide sufficient data on which to establish a "norm". Then from analysis of the data it could be ascertained whether additional sampling would be required to provide more comprehensive data for particular contaminants. Because of their greater importance, the total refinery effluent and its principal component streams were deemed to require two sampling periods of 96 hours each to obtain adequate data to represent a "norm".

As soon as the analytical data were assembled they were reviewed to determine if the results were complete enough to indicate the type and concentration of contaminants anticipated in a particular stream, and if any conditions had been uncovered which would indicate concentrations markedly different from those of the preliminary survey. Supervisory conferences then correlated the contaminant concentrations to normal or abnormal operating conditions.

Data showing the relation and effects of different sources of contaminants are useful in planning effluent-improvement projects. Continuation of routine sampling of the total effluent can be used to indicate significant changes in effluent quality, and also to determine the effects of major changes in processing operations on stream pollution.

In addition to comprehensive surveys of refinery waste effluents, a new rapid and direct method of determining the pollution of a stream by a study of its diatom flora appears promising. Diatoms are one-celled organisms which constitute a river's most widely distributed group of aquatic plants. They are among the most important food resources in the complex chain of aquatic life, and also aid in replenishing the oxygen supply of rivers by the process of photosynthesis.

A study of diatom flora provides a reliable index to the "health" of a river, because the large number of diatom species vary in their tolerance of adverse conditions. Hence, the degree of development of the different diatom species can be used to indicate the river condition.

Key to this new technique, developed by the Academy of Natural Science of Philadelphia, is the Catherwood Diatometer—a small lucite box-trap which is anchored in the water, facing upstream, and floated at any desired depth. An adjustable V-shaped guide directs a steady flow of water through a battery of six to eight slides arranged vertically in the frame. The diatoms grow on the slides during the two week period which the diatometer is suspended in the water. Trained technicians then count, identify, and make a statistical study of the tiny one-celled plants. Most analyses can be completed in four days. The American Petroleum Institute is currently sponsoring calibration of the diatometer for use in bays and estuaries.

An important feature of this method is that the slides in which the diatoms are collected can be stored indefinitely without special treatment, providing a permanent record that is readily available for future reference.

From the standpoint of stream pollution control, the diatometer provides a continuous check on the following aspects:

1. Indicate the extent of pollution that a waste effluent might contribute.
2. Determine whether a certain effluent is actually responsible for the pollution of a stream.
3. Establish when pollution commenced.
4. Determine the effectiveness of corrective treatments.
5. Guide the proper planning of waste disposal methods according to the condition of a stream.
6. Indicate whether a stream is improving or deteriorating over a period of time.

A major stream-pollution problem which has long engaged the attention of refiners is the collection and treatment of waste water containing oil. In the course of refining operations, oily wastes are released to sewers via leaky connections, line breakages, water withdrawal from product accumulators, equipment cleaning, and similar conditions.

The conventional method of preventing the escape of waste oil into streams involves drainage and collection installations, together with gravity-type oil separators which remove the oil and sludge from waste waters. These primary waste-treating facilities may be supplemented by secondary waste-treating facilities which remove undesirable waste solutes and reduce the biological-oxygen demand (BOD) of the water.

Oil reclamation and waste-disposal facilities incorporating the latest recommendations of the American Petroleum Institute are being installed at Skelly Oil Company's El Dorado, Kansas, Refinery. Current waste-water effluent at this refinery normally amounts to about 1,500 gallons per minute exclusive of sanitary sewage. However, a two-inch hour rainfall can increase this volume to handle 101,000 gallons per minute, with about 3,000 gallons per minute flowing in the oil sewer as process water.

A gravity-type oil-water separator with adequate capacity to handle 101,000 gallons per minute would require 40 single-stage chambers, each 20 feet by 75 feet by 8 feet. Therefore, a 17 million gallon earthen impounding basin capable of handling the runoff water from a five-inch rainfall was constructed. This impounding basin makes possible an 85 percent reduction in the size of the separator without loss of control over waste oil in the water. When the water-runoff rate approaches the design capacity of the separator, water will automatically start to flow into the basin. Then after the storm is over, the water can be pumped through the separator for removal of oil.

The capacity of the gravity oil-water separator was arbitrarily set at 15,000 gallons per minute so that the basin may be emptied in 24 hours by pumping through the separator at a rate which does not exceed the separator rating. The separator may be operated either as a single unit, or it may be partitioned with steel gates and operated as two separate units—two chambers handling process water and four for storm runoff. This provides a means of isolating process water and taking it separately to secondary treating facilities.

Major portions of oil and sludge are removed in the separator forebay with oil-skimming and sludge-removal equipment identical to that installed in separation chambers. Oil-skimmer pipes drain to a collecting pipe which carries the skimmer oil to a pump from which it is pumped into tanks.

When emulsification of the oils prevents gravity separation, the emulsion is broken in a batch-wise process utilizing heat and demulsifying agents. However, this method increases the alkalinity of an already alkaline waste effluent, and it produces waste water and sludge which are difficult to prepare for fuel disposal. Hence, Skelly is considering the use of a filter to break emulsions and thereby avoid these sludge and waste disposal problems.

The general problem of waste-water emulsions is complex because of variations in the sources and properties of emulsions. Consequently, continual supervision and flexible control apparatus are necessary to insure effective treatment.

The initial step in handling this problem is to locate, identify, and classify refinery emulsions. If treatment other than gravity separation is required, two general methods are available. The preferable procedure utilizes an emulsion-collecting system for the major offending wastes, which are subsequently treated at a central plant or plants. This procedure segregates emulsified liquid wastes from process-, storm-, and cooling-waters. Although this approach requires a multiple sewer system, it has the advantage of treating a reduced volume of waste water. It is recommended for new plant installations.

When an emulsion-collection system is not feasible, an alternative method can be employed whereby all waste waters from one combined sewer system are treated in a central plant.

In both methods, the waste emulsions

(Continued on page 138)

"Klingerit"

COMPRESSED
ASBESTOS
SHEET PACKINGS

proved the best by the test of time

FIRST IN 1886 - - -
FOREMOST TODAY

Write for the Klinger Master Catalog which describes the complete range of Klinger products, compressed asbestos sheet packings for all purposes, valves, cocks, metal gaskets, synthetic and silicone rubbers.

RICHARD KLINGER LIMITED, KLINGERIT WORKS, SIDCUP, KENT, ENGLAND

Manufacturing Licensees for Canada

JOSEPH ROBB & COMPANY, LIMITED
5575, COTE ST. PAUL ROAD, MONTREAL 28, CANADA
Telephone: WILBANK 3181 Cable: ROBCO
Branches at: SYDNEY, N.S., HALIFAX, N.S., OTTAWA, Ont., TORONTO, Ont., HAMILTON, Ont., WINNIPEG, Man., EDMONTON, Alta., VANCOUVER, B.C.

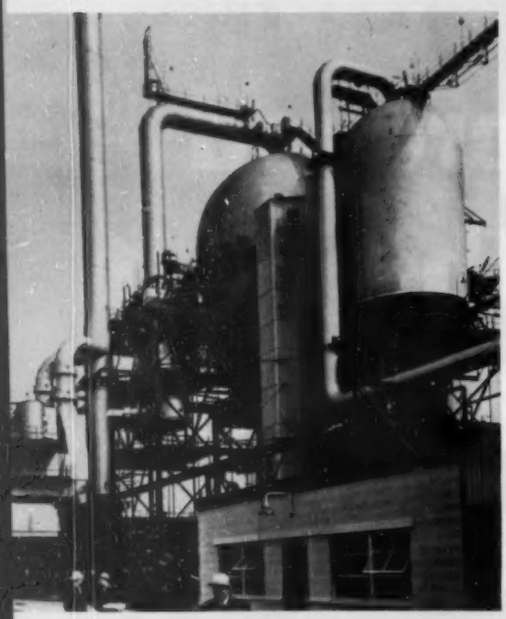
Agents throughout the World

Manufacturing Licensees for U.S.A.

THE KLINGER CORPORATION OF AMERICA
95, RIVER STREET, HOBOKEN, NEW JERSEY, U.S.A.
Telephone: HOBOKEN 3-7913 Cable: KLINGDALE
New York
Telephone: WHITEHALL 4-5390

General Petroleum Corporation's new 35,000 b/d refinery at Ferndale, Wash., is rapidly taking shape. Canadian crude will be processed when the plant goes on stream before the end of the year.

A survey crew at work on the shores of the York River which borders the 1,200-acre site near Yorktown, Virginia, where the Pan American Refining Corp. plans to construct a new refinery.



World's largest catalytic cracking unit recently completed at Gulf Oil's Philadelphia refinery. New unit has a capacity of 63,750 b/d.

U.S. Review

(Continued from page 85)

ing the process to other companies. Work was begun early this year at the company's Whiting, Indiana refinery on a Hydroformer which will produce up to 22,000 barrels daily of high octane blending stock. A petrochemical plant built in connection with the Whiting refinery for the production of detergent alkylate was put on stream in April of this year.

In March last the officials of Indiana Standard announced that the company had adopted a two year expansion and modernization program on which $500 million would be spent. This is intended to cover both the expansion of production and additions to processing equipment.

Cities Service has continued the enlargement of its East Chicago refinery by adding a 30,000-barrel topping unit engineered by Arthur G. McKee Co., a fluid Hydroformer, and a delayed coker which will enable the plant to process 50,000 barrels of reduced crude per day. Other installations under the general program supervised by the Kellogg company include a feed preparation unit for the Hydroformer, a straight-run gasoline fractionating unit and modernization of the absorber and stabilization unit. The entire reorganization is well advanced and is expected to be completed before the end of the year.

Sinclair Refining Co. is adding a 20,000-barrel gasoline fractionating unit built by Graver Manufacturing Co. to its Chicago refinery and a catalytic reformer designed by C. F. Braun & Co. to be completed in 1955.

A TCC unit of Lummus design is being installed in the East St. Louis refinery of Socony-Vacuum together with a catalytic polymerization unit. Alkylation facilities at this plant are being expanded. Additional installations designed by the company include Sovaformers for its East Chicago, Trenton, Michigan and Augusta, Kansas plants, the two former to be built in 1956.

At Wood River, Illinois, Shell is installing a UOP platformer of 16,000-barrel capacity and Wood River Oil Refining Co. is planning crude topping, cracking and polymerization installations.

Development of production in the Williston Basin has led to the erection of refineries in North Dakota. The largest of these is the Mandan plant of Indiana Standard, with a charging capacity of 30,000 barrels, which is now approaching completion. In this refinery the main operating elements are joined in a single combination unit without intermediate storage. The combination covers an area of nearly 130,000 square feet and includes crude distillation, fluid catalytic cracking, vapor recovery and polymerization. In connection with the refinery, pipe lines are being laid for delivery of crude to the plant and a 10-inch products line will carry its output eastward to marketing centers.

Continental Oil Co. is adding a delayed coking unit of Kellogg design to its Ponca City, Okla., refinery. The unit has a capacity of 12,500 barrels daily and when completed will produce 3,250 barrels of gasoline, 7,000 barrels of gas oil and 413 tons of by-product coke per day.

Kerr-McGee Industries Inc. is expanding its plant at Wynnewood, Okla. by installing a 15,000-barrel crude still built by Koch Engineering Co. and a fluid cracker and polymerization unit under supervision of Refinery Engineering Co. At West Tulsa, Okla., Midcontinent Petroleum Co. is installing an Atlantic catalytic reformer of 7,500 barrels under supervision of the Kellogg company. At Duncan, Okla., Sunray Oil Co. is spending $5.3 million on a UOP platformer and a Lummus designed coking unit.

Pan American Southern has installed hydroformers in its plants at El Dorado, Arkansas, and Destrahan, Louisiana.

Shell has expanded major facilities at its Norco, Louisiana, refinery, adding a crude distillation unit, a catalytic cracking unit with feed preparation and product recovery, alkylation and polymerization units as well as various utilities. The changes will be completed this year and will raise the plant's throughput to 75,000 barrels per day.

Twin pipestills of 60,000 b/d went into service at the Baton Rouge refinery of Esso Standard during the past year, raising the plant's capacity to 300,000 b/d. An expansion of the fuel products section of the plant is under way and a fluid hydroforming unit of 20,000 b/d is scheduled for completion in 1955.

Continental Oil Co. in May announced completion of its enlargement program at Lake Charles, Louisiana, with the plant in full production at 45,000 b/d. The new crude unit designed to process 30,000 barrels daily has been operated at 38,000 b/d. A portion of the topped crude produced is transferred by pipe line to the nearby Cit-Con lube oil plant, jointly owned by Continental and Cities Service. Two TCC cracking units of Socony design are contained in a joint structure and feed into a common fractionating system. Products include ab-

"Phi Beta McKee"

● It's the little gold lapel insignia McKee engineers wear. The color of the stone shows the number of years a man has been in the organization, and a good many of them show twenty-five years and more.

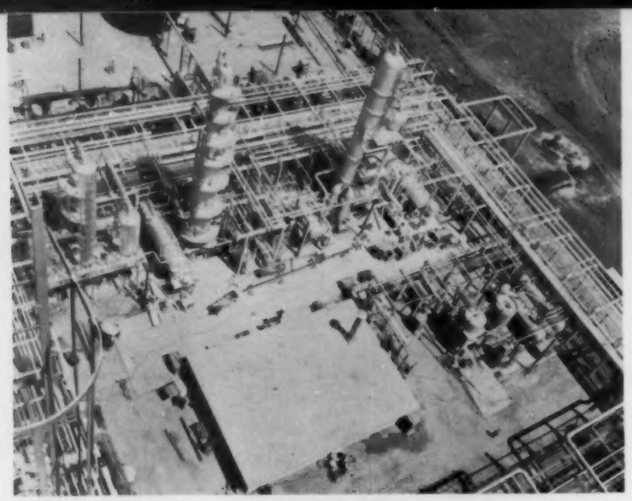
Sure, we do a little kidding about them—call 'em our "Phi Beta McKee's"—but we wear them with pride. That's because they really mean years of ***experience,*** and in this highly specialized business of designing and building petroleum and chemical processing plants, experience pays off.

The design, engineering or construction of a modern refinery or chemical plant is a complex undertaking requiring the coordinated effort of many kinds of technical specialists and skilled craftsmen. Here at McKee we have it down to a smooth-working system because so many of us have been working together at it for so many years.

McKee Engineering Services

Arthur G. McKee & Company • Engineers and Contractors

Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York • Tulsa, Oklahoma • Union, N. J. • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 350 Bay St., Toronto



View from TCR unit at Torrance, Calif., refinery of General Petroleum Corp., showing piping and tower layout built around the control house.

U.S. Review

(Continued from page 110)

sorber gas, stabilized cracker gasoline and a refractory cycle gas oil which is delivered to the adjacent carbon black plant. Other units of the plant are a UOP reformer, a vapor recovery system, a sulfuric acid alkylation unit, catalytic polymerization and aromatics extraction. Engineering, except for the platformer, which was supplied by Procon, was by the Badger division of Stone and Webster Engineering Corp.

In the Gulf Coast area, Gulf Oil Corp. is adding a 20,000-barrel platformer to its Port Arthur refinery with construction by Fluor Corp. and completion planned for 1955. At the same plant Gulf is installing an ethylene plant of 600,000 pounds daily capacity. Both of these units are said to be the largest of their kind.

Humble Oil and Refining Co. is adding to its Baytown refinery a 75,000-barrel pipestill of Foster Wheeler design and a catalytic polymerization unit by Hydrocarbon Research.

At Shell's Houston refinery a benzene and toluene platforming unit was put into operation during the year capable of producing more than 450,000 barrels a year of benzene (10 percent of the nation's output) and 785,000 barrels of toluene. At Texas City an ultraforming unit is being added to the refinery of Pan American Refining Co. A UOP platformer of 16,000-barrel capacity is being erected in the Phillips refinery at Sweeny, Texas.

A 20,000-barrel catalytic reformer is approaching completion at the Port Arthur refinery of The Texas Co. and a duplicate is to be added in 1955. The company also is putting through a complete modernization program at its El Paso and Amarillo, Texas, refineries. Magnolia Petroleum Co. is introducing a thermal catalytic reforming unit (TCR) in its Beaumont, Texas refinery.

In the Rocky Mountain region, Carter Oil Co. is expanding its catalytic cracking equipment by the addition of 15,000 barrels capacity. Standard Oil Co. of Indiana has placed a contract with The Lummus Co. for a 3,750-barrel Ultraforming unit to be completed in 1955. An alkylation unit now under construction is expected to be ready for operation shortly.

Union Oil Co. is installing an Atlantic-type catalytic reformer at its Cut Bank, Montana, refinery with engineering by the Ralph M. Parsons Co.

Phillips Petroleum has completed plans for a refinery at Great Falls, Montana and has under consideration further plans for construction in the Rocky Mountain area.

On the Pacific Coast an extensive program of refinery construction and enlargement is being carried forward. Richfield Oil Corp. is adding 20,000 barrels to the daily capacity of its Watson refinery by installing a catalytic cracker, vacuum unit and other processing facilities with engineering by C. F. Braun & Co. Similar enlargement is taking place at Los Angeles.

General Petroleum Corp. is installing at its Torrance, Calif., plant a Socony-type thermal catalytic reformer of 19,000-barrel capacity, construction being in charge of the Bechtel Corp. The Texas Co. is adding a platforming unit and hydrotreater to its Wilmington refinery under the engineering direction of C. F. Braun & Co. Other additions include steam generating equipment, tankage and water cooling facilities. The work is scheduled for completion during 1955.

Tide Water Associated Oil Co. has begun construction of a hydrobon-platformer designed by C. F. Braun & Co. to produce 10,000 barrels daily of premium grade motor fuels. Other additions to this plant are under consideration. Union Oil Co. is installing a unifining process and a platformer at its Oleum refinery. Shell Oil Co. has replaced some of the older equipment in its Wilmington, Calif. refinery with a new crude distillation unit which adds about 17,000 barrels to the daily throughput. At the Martinez plant of Shell, a UOP naphtha platforming unit is being constructed.

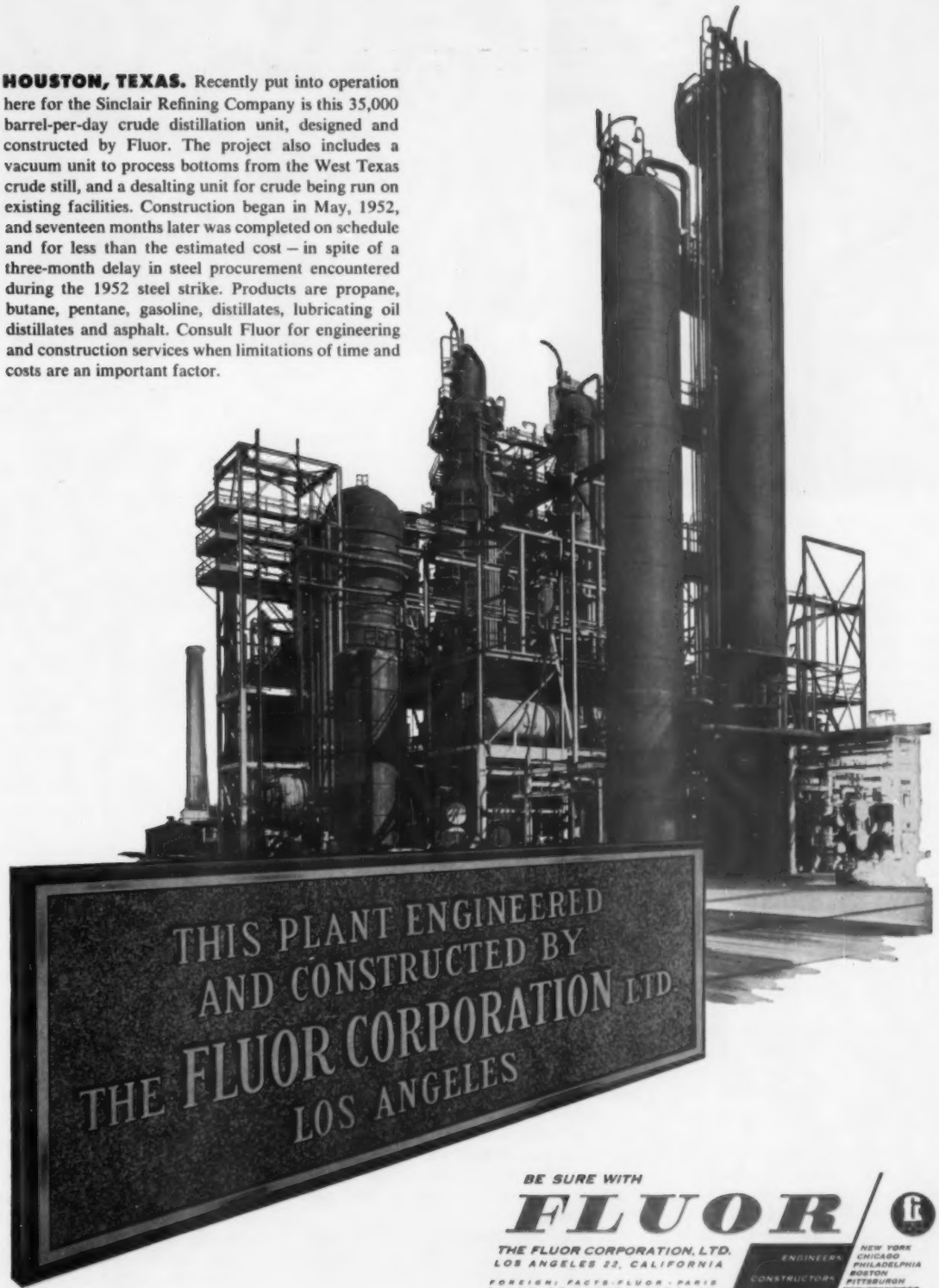
At the El Segundo refinery of Standard Oil Co. of California, a large scale construction program representing an investment of $20 million or more is approaching completion. It includes a 40,000 b/d catalytic cracker, a 52,000 b/d residuum stripper, alterations to naphtha rerun stills and expansion of the existing alkylation unit in addition to a cumene plant already in operation.

At the company's Richmond refinery, a phenol plant which has been under construction for some time is now on stream. It is described as the first to produce phenol directly from petroleum using cumene drawn from El Segundo.

Availability of Canadian crude to the extreme northwest following completion of the Trans Mountain Pipe Line has resulted in the erection of refineries in the Puget Sound area to serve that rapidly developing section of the United States. The first of these, a 35,000-barrel plant built by General Petroleum Corp. at Ferndale, Washington, is well along toward completion and will be put in operation before the end of the year. It includes a crude unit, a visbreaker, a TCC cracking unit, a catalytic reformer and vacuum unit, besides the usual accessory equipment. The estimated cost of the plant is $35 million. Construction is being done by the Bechtel Corp.

Shell Oil Co. is preparing to build a refinery at March's Point near the town of Anacortes, Washington. Like the Ferndale plant, it will be fed by Canadian crude. The Anacortes plant will have a daily charging capacity of 50,000 barrels. Its equipment will include a crude distillation unit, catalytic cracking unit, naphtha platformer, gas recovery and polymerization units. It is stated that the refinery will incorporate a development in the basic fluid catalytic cracking process which increases the commercial value of the products of cracking and at the same time provides greater flexibility in meeting seasonal changes in the demand for heating oils. The refinery investment is estimated at about $75 million. It is hoped to have its first units in operation some time in 1955.

HOUSTON, TEXAS. Recently put into operation here for the Sinclair Refining Company is this 35,000 barrel-per-day crude distillation unit, designed and constructed by Fluor. The project also includes a vacuum unit to process bottoms from the West Texas crude still, and a desalting unit for crude being run on existing facilities. Construction began in May, 1952, and seventeen months later was completed on schedule and for less than the estimated cost – in spite of a three-month delay in steel procurement encountered during the 1952 steel strike. Products are propane, butane, pentane, gasoline, distillates, lubricating oil distillates and asphalt. Consult Fluor for engineering and construction services when limitations of time and costs are an important factor.



BE SURE WITH

FLUOR

THE FLUOR CORPORATION, LTD.
LOS ANGELES 22, CALIFORNIA

FOREIGN FACTS-FLUOR - PARIS
FLUOR OF CANADA - TORONTO
FLUOR INTERNATIONAL - BEIRUT
FLUOR PERUANA, S.A. - LIMA
HEAD WRIGHTSON - LONDON

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA

Left: Construction scene at new $30 million expansion program at Altona, Australia, refinery of Standard-Vacuum Refining Co., Pty., Ltd.

Above: Clay hopper and mixer at the new industrial lube unit of Porto Marghera refinery, Venice, Italy.

Eastern Hemisphere Review

(Continued from page 93)

when completed, the project will represent an investment of $85 million. It will employ the Synthol process developed by Kellogg for catalytically reacting gas from the controlled combustion of coal. The plant is designed to handle 7,600 tons of raw material per day and to have a yearly production of 55 million gallons of motor gasoline, 4.5 million gallons of gas oil and around 1.5 million gallons of fuel oil. This will be in addition to about 15 million gallons of industrial chemicals, fertilizer and other chemical products.

In the Near East the most notable event of the year has been the construction of the completely new 100,000 barrel refinery of Anglo-Iranian Oil Co. at Aden which is described in detail in another part of this issue.

At Ras Tanura, Saudi Arabia, the Arabian American Oil Co. added a crude topping installation and a catalytic polymerization plant to its refinery in the latter part of 1953, thereby raising throughput above 200,000 barrels daily. In late 1954, construction will start on a $12 million catalytic reformer which is scheduled to come into operation at the beginning of 1956. Engineering of this unit is in the hands of The Lummus Co.

Bahrain Petroleum Co. is adding a 25,000 barrel vacuum still to the equipment of its Persian Gulf refinery to be completed in 1955.

Mediterranean Refining Co. is erecting a plant of 6,250 b/d at Sidon, Lebanon under supervision of Bechtel Associates to supply products to the local area.

On a site at Bourah on the banks of the Tigris River near Baghdad, M. W. Kellogg Co. is constructing a $25 million refinery of 24,000 barrel capacity for the government of Iraq for processing royalty oil. The undertaking is truly international by reason of the many specialists who have contributed their skill and experience to it. The foundations were designed by Maunsell, Posford and Pavry, British engineering consultants; the civil engineering work for all foundations and roads is being carried out by D. & C. & William Press Ltd.; the steam generating plant designed by Ewbank is built by Babcock & Wilcox; the sulfuric acid plant is by Cyanamid Products Ltd.; and erection of the storage tanks has been done by Motherwell Bridge Contracting and Trading Co. Ltd. Towers for the refinery were fabricated in the United States and shipped as deck cargo to Basrah whence they were transported to the plant site on flat cars specially built for the purpose.

Work is progressing on the 6,250 barrel refinery being built by the Ralph M. Parsons Co. at Batman, Turkey, for government account. Completion is expected before the end of the year. The plant is designed for the production of motor gasoline, kerosine, diesel oil, jet fuel, fuel oil and asphalt.

In the Middle East, extended negotiations between the government of Pakistan and Burmah Oil Co. have resulted in an agreement for a new refinery. In Burma, a distillation unit of 2,500 b/d is being added to the Chauk refinery.

India is looking forward to the establishment of a modern refining industry through the erection of three new processing plants. One of these is the Burmah-Shell refinery, ownership of which is indicated by its name. It is located near Bombay, has a designed capacity of 40,000 b/d, and is expected to be completed in 1955 at a cost of $47 million. On Trombay Island, near Bombay, Standard Vacuum is constructing a refinery of 25,000 b/d that will be completed in the latter half of the year. The plant represents an investment of about $30 million. It will be operated by Standard Vacuum Refining Company of India Ltd., in which private Indian capital will have a 25 percent preference share interest.

The new refinery incorporates the latest design of "combination unit" operations, employing a maximum of process integration. The basic processes are crude distillation, thermal reforming, Model IV fluid catalytic cracking, sulfur dioxide extraction and combined sweetening.

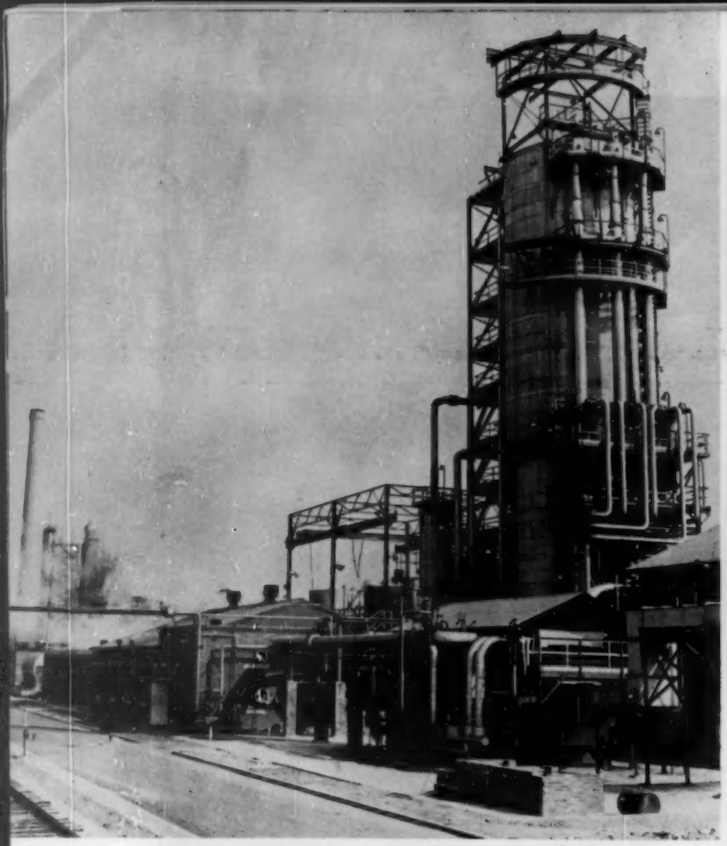
William A. Williams is managing director of the new Stanvac subsidiary. The Lummus Company is the prime contractor.

The third plant is projected by Caltex for a charging capacity of 10,000 b/d. It is to be located at Vishakapatnam and construction is expected in 1955.

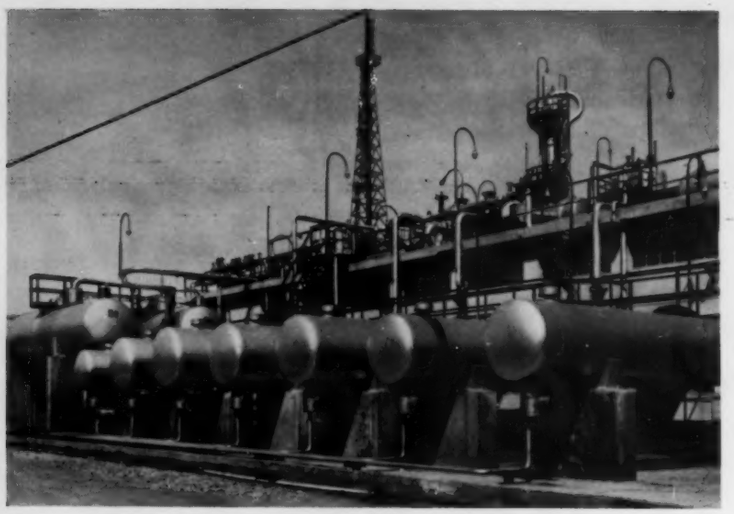
Australia is another country experiencing a manifold expansion of its refinery facilities with four new plants under construction. The first of these to be completed is the Shell refinery at Geelong,* southwest of Melbourne, which was formally opened in March of this

* See WORLD PETROLEUM, June 1954

IN CANADA: DIKKERS LTD., TORONTO

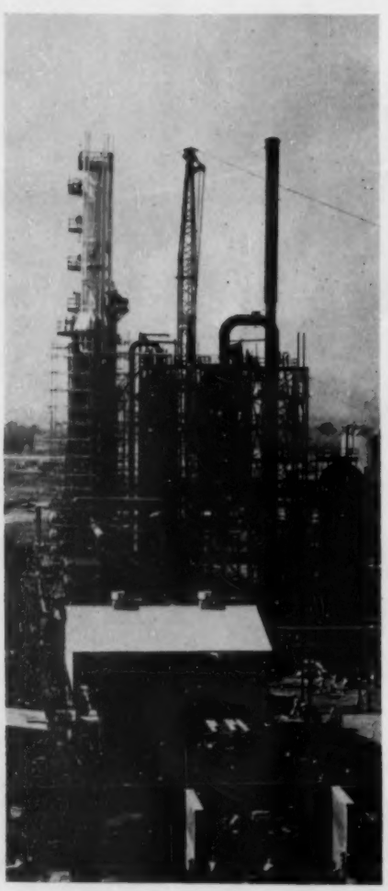


Left: Vacuum unit for lube feedstock preparation at Anglo-Iranian Oil Company's Llandarcy refinery, South Wales.



Above: Duo-Sol extractors at STANIC Leghorn, Italy, refinery.

Combination unit at the Bombay refinery of Standard-Vacuum Oil Co. of India, Ltd. Plant is scheduled to begin operation this month.



year. It was equipped by the Netherlands engineering firm Werkspoor of Holland and associated companies for a throughput of 25,000 barrels and was constructed at a cost of $22.5 million.

At Altona, Vacuum Pty. Ltd., subsidiary of Standard Vacuum, is expanding the capacity of its plant to 25,000 b/d. The engineering work is conducted by Braun Transworld Corporation and completion is scheduled for 1955. New processing equipment, involving an expenditure of approximately $30 million, includes a crude distillation unit, Thermofor catalytic cracking facilities and treating equipment, together with the necessary boiler capacity, pumps and tankage. A catalytic reformer for further improvement of gasoline quality is scheduled for completion in early 1956.

When the expansion program is completed, the refinery will produce gasoline, jet fuel, diesel oil, industrial fuel oil, bunker fuel oil, lubricating oils and asphalts. Aviation gasoline will be added to this list of products with the completion in 1956 of an alkylation plant which was announced earlier this year.

The plant will be operated by Standard Vacuum Refining Company, Pty., Ltd., of which Richard B. Price is the managing director.

Australian Oil Refining Ltd., a subsidiary of Caltex, is constructing a plant of 21,000 barrels capacity at Kurnell to be erected in 1955.

Anglo-Iranian's Kwinana refinery is being built near Freemantle on the west side of the Australian continent. When completed it will be the country's largest processing plant, with a charging capacity of 60,000 b/d. Construction is now at about the halfway point. Design and engineering is in the hands of the Kellogg Company, and leading British contractors, including Costain-John Brown, Kinnear Moodie and D. & C. & William Press Ltd., are participating in the work of erection.

In order to give ocean tankers access to the refinery it was necessary to do extensive dredging of sand bars at the entrance. The port improvement includes the building of an oil jetty large enough to accommodate three 32,000-ton tankers simultaneously.

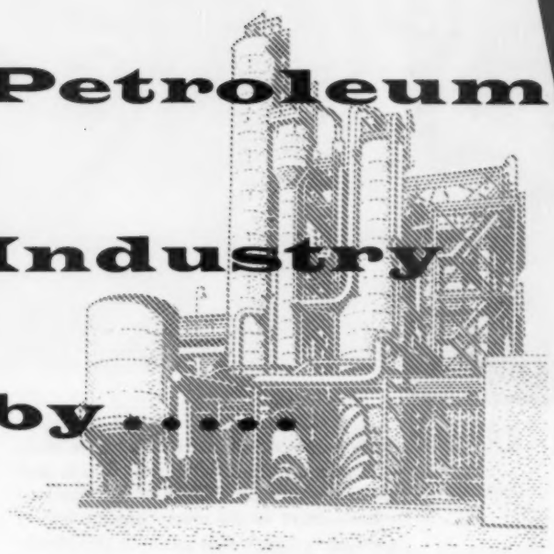
The refinery is designed to produce gasoline, diesel and gas oil, aviation turbine fuel, kerosine and fuel oil. Its two atmospheric distillation units will handle 1,500,000 tons each in the course of a year, crude residue being passed to a vacuum distillation unit. Heavy naphtha will be treated in a Platforming installation with an annual capacity of 250,000 tons to yield high octane spirit. A Hydrofining unit will treat kerosine and gas oil.

Pipe lines from the refinery will carry products to Freemantle, one of 12-inch diameter conveying fuel oil to the bunkering station and the other of six inches moving motor fuel to existing tankage from which it will be distributed.

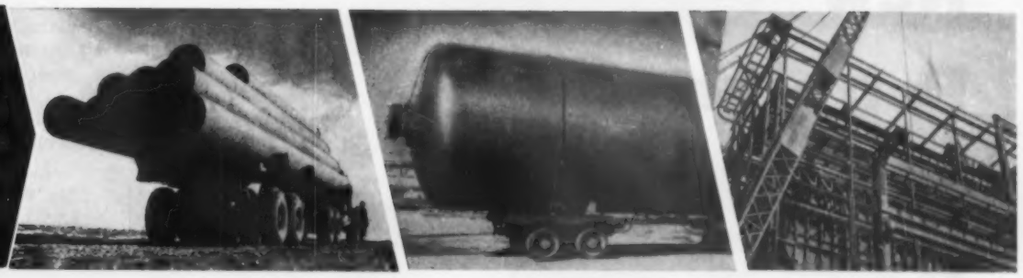
A noteworthy addition to refining facilities in the Pacific area is the 13,000 b/d plant being erected at Batangas, Philippine Islands, by a Caltex subsidiary and due for completion before the end of 1954.

The refining situation in Japan is discussed in an article appearing elsewhere in this issue.

Steel Products for the Petroleum Industry by.....



SOUTH DURHAM



PIPES . . . . . In addition to steel pipes of ordinary Commercial quality South Durham manufacture pipes welded inside and outside by the submerged arc process to meet the special requirements of the petroleum industry in diameters of 16 inches and up to A.P.I. Specifications 5L and 5LX.

TANKS & PRESSURE VESSELS All problems of liquid storage are met by the Company's facilities for tank and pressure vessel construction. Welded and mild steel tanks are fabricated to Class I and Class II requirements and the Company is on Lloyd's List for recognised welding standards.

STRUCTURAL STEELWORK . The Company's constructional department undertakes the design, fabrication and erection of structural steelwork for all types of general industrial structures and petroleum installations.

SOUTH DURHAM

SOUTH DURHAM STEEL & IRON CO., LTD.
(Incorporating CARGO FLEET IRON CO., LTD.)

MALLEABLE WORKS, STOCKTON-ON-TEES, ENGLAND.

Telephone: Stockton-on-Tees 66117. *Telegrams*: "Malleable," Stockton-on-Tees.
CODES: Lieber's Standard; ABC 5th Edition; Western Union; Bentleys; Lombards.

The $15 million plant of Canadian Industries Ltd. at Edmonton is Canada's first producer of polythene "flake." The C.I.L. plant is supplied with gas through a 20-mile pipe line from the Leduc oilfield, one of the richest in the component ethane on the North American continent. The plant requires about 10,000,000 cubic feet of gas a day.

Six New Petrochemical Plants On Stream In Canada

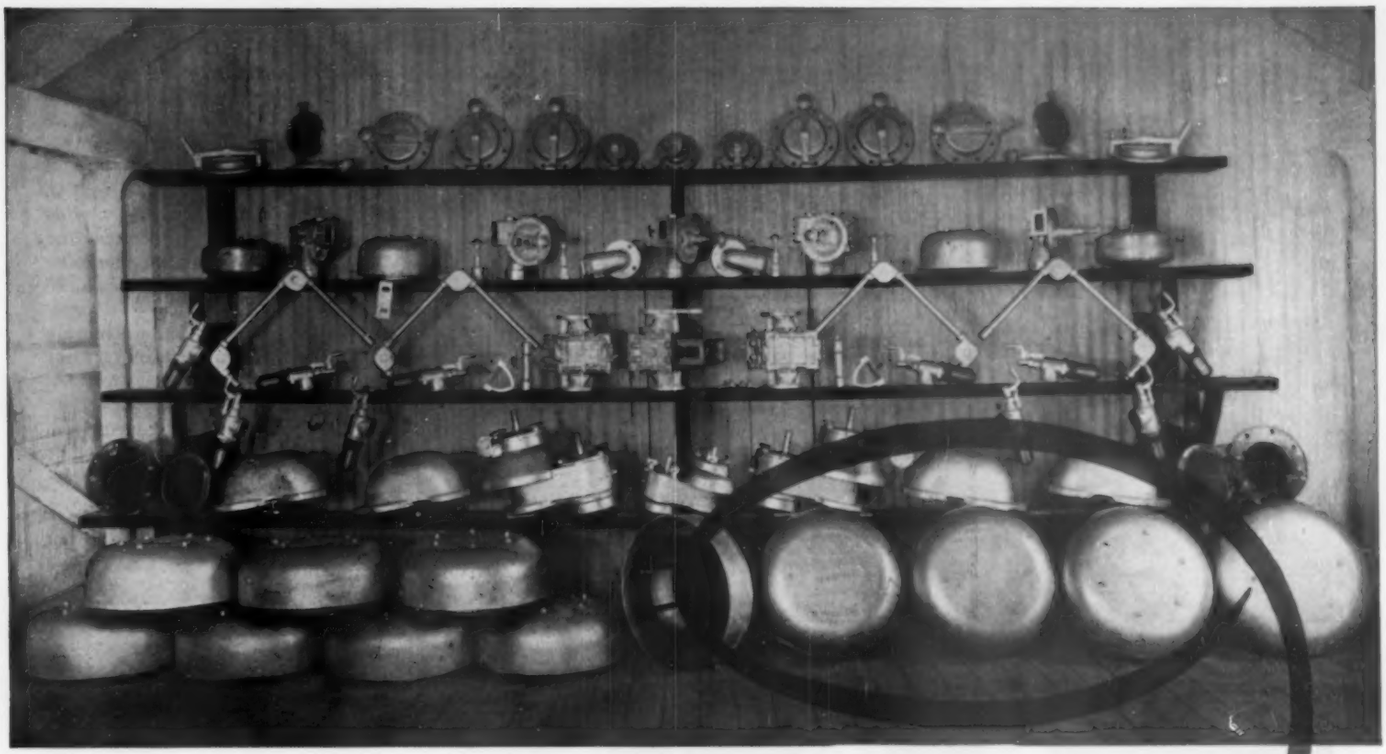
CANADA INVESTED more than $100 million in new petrochemical plants and enlarged a number of earlier installations in 1953. Part of the new construction is based on refinery still gases in the Montreal and Sarnia areas, part on the vastly increased reserves of western natural gas.

Plants costing about $68 million to process natural gas were placed on stream at Edmonton, Alta., thus concentrating about 40 percent of Canada's petrochemical industry in that city. They are the polythene plant of Canadian Industries Ltd. and the multi-product plant of Canadian Chemical Co. Ltd., an affiliate of Celanese Corp.

The CIL polythene plant, costing $13 million, processes 10 million cubic feet of gas daily piped from the Imperial Oil Ltd. pressure maintenance installation at Devon. The gas from fields adjacent to Edmonton is a highly satisfactory raw material because of its high ethane content. At the CIL plant the concentrated ethane is cracked to ethylene and polymerized to polythene flake. Plant output approximates 6,000 tons per year and is in excess of current Canadian demand, so that exports will be necessary. The Edmonton plant was begun in 1952 and completed in October 1953. It now is planned to spend $1 million in 1954 to expand polythene production to 16 million pounds per year.

The adjacent $55 million chemical plant of Canadian Chemical and Cellulose Co. comprises 17 buildings covering an area of 200 acres. It was engineered and built by Brown & Root Ltd., the construction requiring two years.

(Continued on page 120)



WM. NEILL & SON (ST. HELENS) LTD

Offer British made "VAREC" tank fittings manufactured to the designs of the Vapor Recovery Systems Co., of Compton, California. "VAREC" fittings are being supplied in large quantities for the Petroleum Industry for home and overseas use and the above photograph shows a number of such fittings recently supplied.

Fully descriptive catalogues are available upon request.

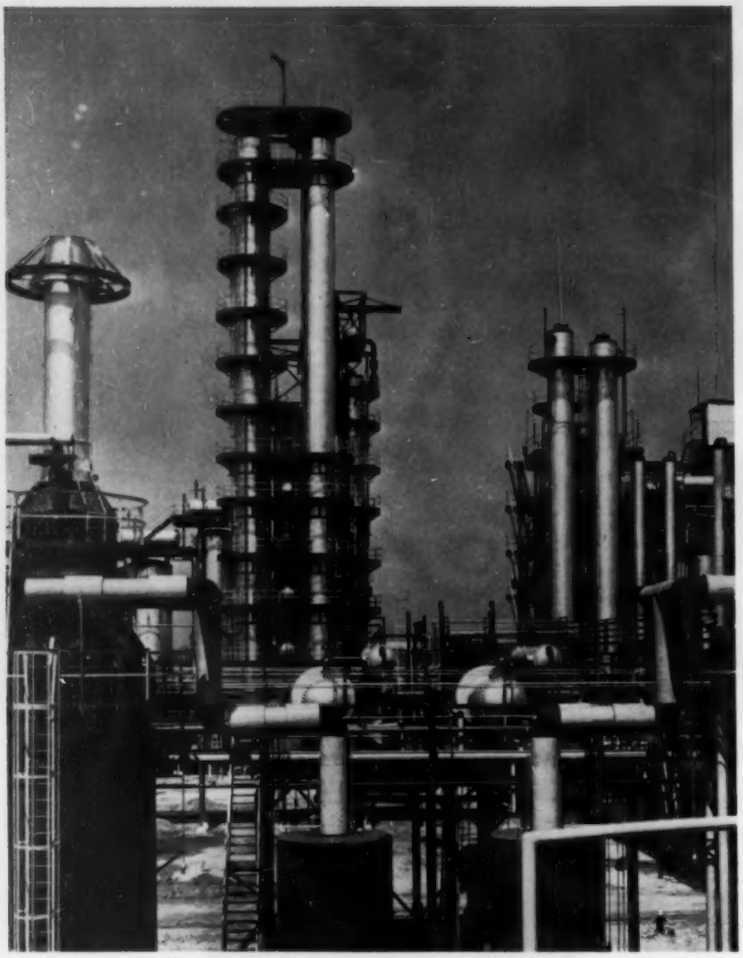
★

The free vents shown opposite are designed for use on atmospheric vessels containing non-volatile products. Both types are equipped with mesh screens to prevent the entry of foreign matter. Standard of materials of construction are cast iron and/or aluminum.

Fig. No. 7000

Fig. No. 26 & 27 series

HEAD OFFICE AND WORKS
BOLD IRON WORKS
ST. HELENS JUNCTION, LANCS. ENGLAND
Telephone ST. HELENS 2817
LONDON OFFICE
38 VICTORIA STREET, LONDON S.W.1.
Telephone ABBEY 5343



Styrene unit at the Sarnia plant of Dow Chemical of Canada Ltd.

Raw materials consumed are still gases from nearby refineries, natural gas and LPGas, plus cellulose brought in from British Columbia for the synthesis of cellulose acetate. Annual production of cellulose acetate is about 25 million pounds. The plant also produces a wide variety of alcohols, glycols, acetone and acetic acid, aldehydes, oxides and ketones. Gas consumption of the plant is about 75 million cubic feet daily.

Consolidated Mining and Smelting Company's plant at Calgary manufactures ammonia and ammonium nitrate fertilizers, with a world-wide market. Sherritt-Gordon Mines Ltd. is now entering the petrochemical field. A $17 million plant at Fort Saskatchewan will produce ammonia from natural gas. This ammonia will be used as a leaching agent for the recovery of nickel, copper and cobalt. Excess ammonia will be used for the production of chemical fertilizers.

Canadian Industries Ltd. is building an explosives plant near Calgary which will process ammonia produced from natural gas.

New British Dominion Oil Co. now is negotiating with a United States chemical company for the joint construction of an ammonia plant in Southern Alberta. Proposal is to process natural gas from the Etzikom area, where substantial reserves have been developed by New British Dominion and Midcon Oil & Gas Co. Reserves in this field have been estimated at 108 billion cubic feet.

Sulfur now is manufactured by Royalite Oil Co. at Turner Valley and Shell is expanding its Jumping Pound gas processing plant.

(Continued on page 125)

The $60 million petrochemical plant of Canadian Chemical Co., a subsidiary of the Celanese Corporation of America, is the world's first self-contained petrochemical plant and integrates three phases of manufacture in one location. Situated on the 430-acre site is the petrochemical division, producing organic chemicals; the acetate division, which makes cellulose acetate, the base material for textile yarns; and the yarn division, manufacturing the fibres for fabrics. Some of these are exported to textile plants of the parent organization in Colombia and Venezuela.

AFTER 38 YEARS of faithful service, Imperial Oil Limited replaced these facilities in British Columbia with a new, completely-integrated 25,000 barrels-per-day refinery. It was engineered and built by Bechtel to the designs of Imperial Oil Limited.

A WELL EARNED REST

Wherever a refinery requires to be expanded to meet the demands of its market—needs to be modernized or completely replaced—Bechtel is available to assist in the retirement of the old and the erection of the new.

All or part of these services are available, to suit individual requirements:

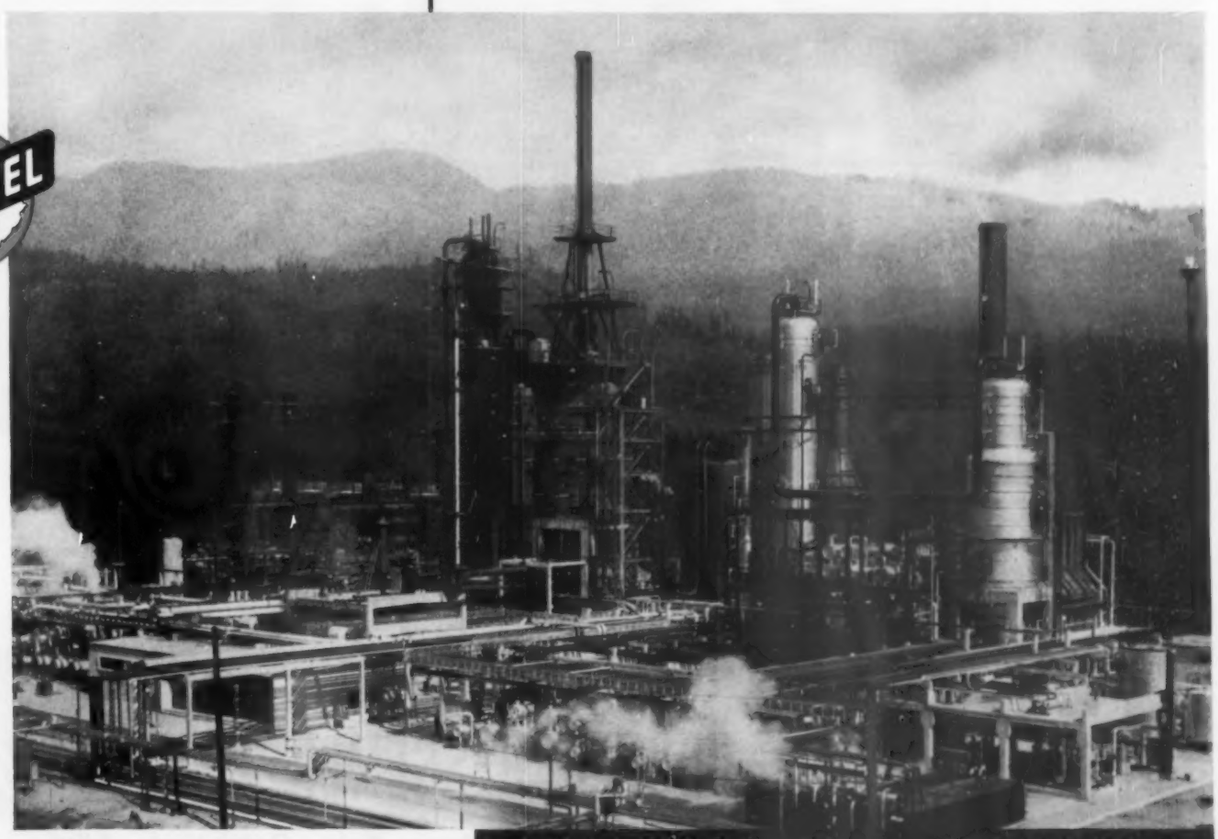
analysis, process design, engineering, procurement and construction

BECHTEL CORPORATION

Los Angeles • **SAN FRANCISCO** • *New York*

CANADIAN BECHTEL LIMITED • *Toronto*

BECHTEL



BUILDERS FOR INDUSTRY

EM2's for Oil Refineries

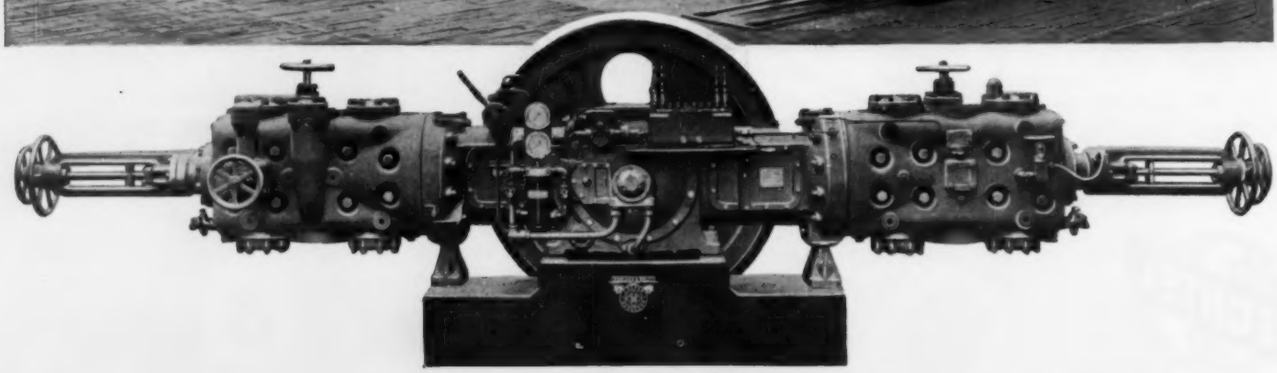


Illustration shows four EM2 type H&W-Cooper-Bessemer Gas Compressors, for direct coupling to electric motors, on test bed. Three of these are for the hydro-desulphurisation unit of the Shell refinery at Stanlow and one for the Consolidated Refineries Haifa Refinery.
These EM2 type compressors have cylinders designed for low vacua or for pressures ranging up to 6,000 lbs. per sq. in.

H&W-Cooper-Bessemer Compressors are particularly designed for high-pressure applications in the Petro-chemical industries as well as oil refineries.

Other H&W-Cooper-Bessemer type compressors are available in many sizes and with a great variety of compressor cylinders offering a wide range of volumes and pressures for handling air or any kind of gas.

HARLAND & WOLFF COOPER BESSEMER

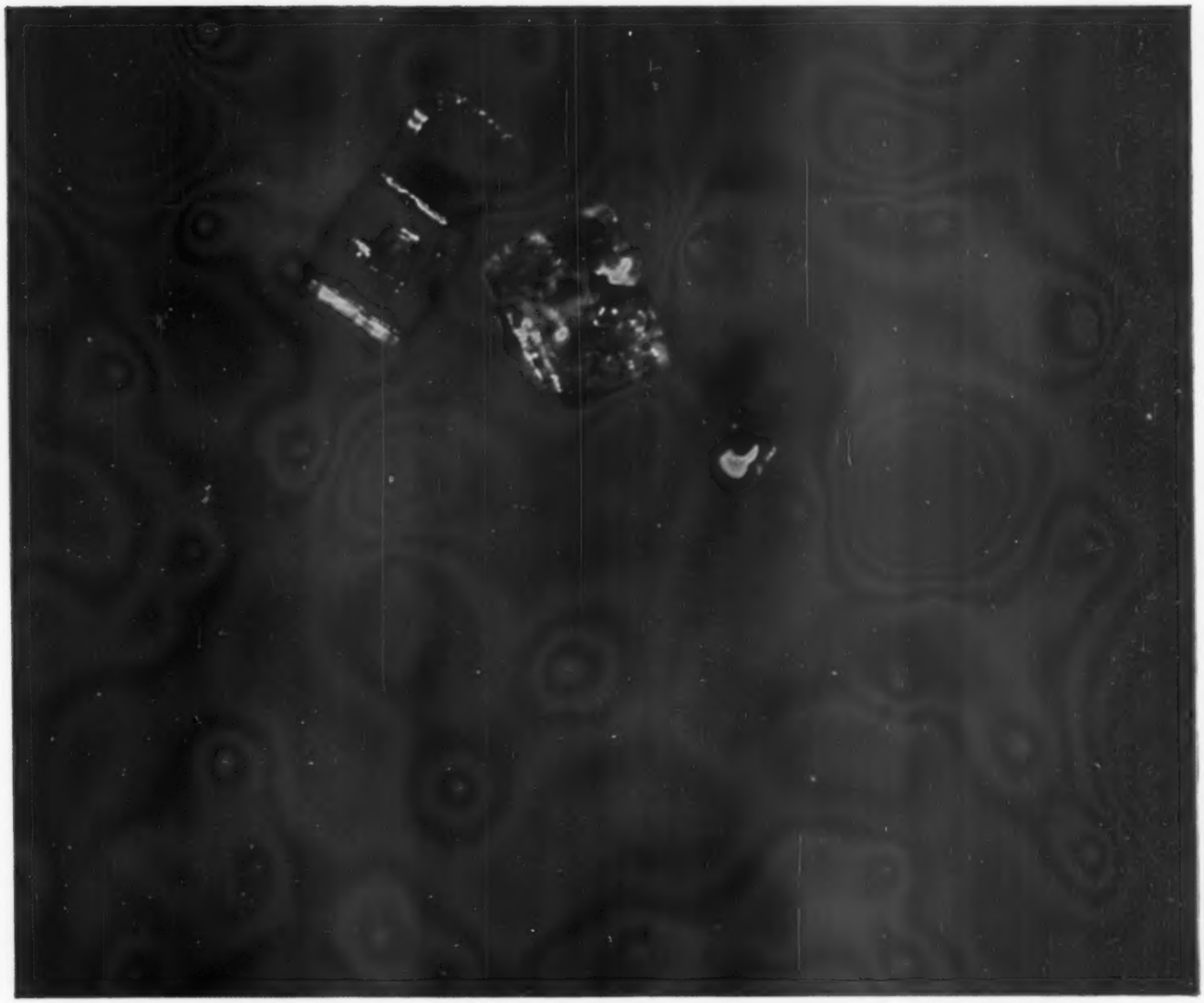
H&W-COOPER-BESSEMER Compressors

HARLAND & WOLFF
LIMITED

Engineering Works: Queen's Island, Belfast.
London Office: 9, Whitehall, S.W.1.

L.237

A beautiful picture...OF TROUBLE



Photomicrograph by J. G. Suthard

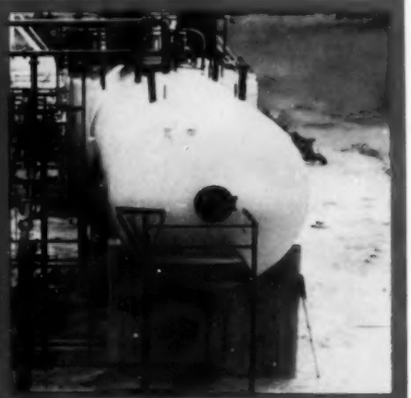
The above photomicrograph shows salt crystals in crude oil, magnified to seventy times actual size. When salts such as these get into refinery equipment, the picture isn't so pretty. Salts in the crude charge invariably result in a substantial decrease in refining efficiency. The only protection against them is effective desalting. You get it, with

PETRECO®
ELECTRIC DESALTING

D54-1

The photomicrograph on the reverse of this page was made as a routine step in Petreco's never-ending study of salts in crude oil and their effects on refining operations. When you consider the merits of a desalting process, it is well to give considerable thought to the calibre of the organization offering the process. Petreco pioneered electric desalting and can back Petreco processing with the know-how resulting from nearly half a century of electric processing experience.

Petreco desalters guard your refinery, day and night, against shutdowns caused by salts, solids and BSandW in the crude charge. You can't get better protection, because you can't get better desalting.



ELECTRIC PETROLEUM PROCESSING

DESALTING • DEHYDRATING
SEDIMENT SEPARATING
DISTILLATE TREATING
DESAPONIFYING

For prompt service, or complete information on Petreco processing, call or write

ARKANSAS
El Dorado: C. B. Lum, Ph. 3-5929

CALIFORNIA
Long Beach: Office, Ph. 407-454
Ojai: H. W. Berg, Ph. 8976
Santa Maria: H. C. Besemer, Ph. 5-2713

INDIANA
Crown Point: O. O. Coulter, Jr., Ph. 1207-M

KENTUCKY
Louisville: H. L. Wilkerson, Ph. AT 7428

MICHIGAN
Bay City: R. W. Becher, Ph. 2-1076
Detroit: D. L. Price, Ph. VErmont 8-3853

NEW JERSEY
Woodbury: G. M. Badger, Ph. 2-1691-W

NEW MEXICO
Artesia: S. M. Laughlin, Ph. 1127

NEW YORK
Buffalo: E. B. Miller, Ph. GRant 6561, BAiley 6252

OHIO
Lakewood: W. A. Dunn, Ph. LAkewood 1-2332; PRospect 1-6432
Toledo: Conrad Stolzenbach, Ph. JOrdon 2305; GArfield 4649
Toledo: F. D. Watson, Ph. WAlbridge 7470

OKLAHOMA
Duncan: R. L. Green, Ph. 3087-M
Ponca City: J. R. Long, ROger 2-1848

TEXAS
Houston: Office, Ph. WOodcrest 7457
Athens: Jack Keeble, Ph. 3719
Beaumont: B. D. Williamson, Ph. 4-1828
Borger: Edward Richard, Ph. 3036-R
Ft. Worth: H. R. Jarvis, Ph. WIlson 4323
Pt. Arthur: C. F. Cline, Ph. 3-0598
Pt. Arthur: I. H. Deaver, Ph. 3-7477
Pt. Arthur: Oliver Wagner, Ph. 2-8820

CANADA
Winnipeg, Manitoba: G. W. Jarrell, Ph. 40-3362

MEXICO
Mexico C'ty: Mont Land, Hotel Continental Reforma

VENEZUELA
Caracas: Mont Land, Hotel Avila
Maracaibo, Zulia: W. F. Faulkner, Apartado 593

PETRECO®

A DIVISION OF PETROLITE CORPORATION

3202 So. Wayside Dr., Houston 1, Texas • 1390 E. Burnett St., Long Beach 6, Calif.

D54-1

PRINTED IN U.S.A.

Petrochemicals in Canada

(Continued from page 120)

The new Shell extensions follow the completion of additional wells at Jumping Pound and will increase handling capacity to 70 million cubic feet daily. This almost triples the original plant capacity of 25 million cubic feet per day. Construction by Refinery Engineering Ltd. of Toronto is due to begin at an early date and the increased quantities of gas will be available for the 1954/55 winter season. Through a contract with Canadian Western Natural Gas Co., Shell supplies processed gas to Calgary, Banff, and other communities in Southern Alberta for domestic heating and industrial use.

A sulfur extraction unit with a rated capacity of 30 tons per day is now operated in conjunction with the gas processing plant. This unit converts hydrogen sulfide scrubbed from the natural gas into elemental sulfur and was the first of its kind to operate in Canada. The sulfur produced is consumed by the British Columbia pulp and paper industry. Shell has under consideration plans for the expansion of this unit to utilize hydrogen sulfide available from the increased quantity of natural gas to be processed.

Canadian Gulf Oil Company has plans for the erection of a $2.5 million sulfur plant at Pincher Creek to produce 150,000 tons per year.

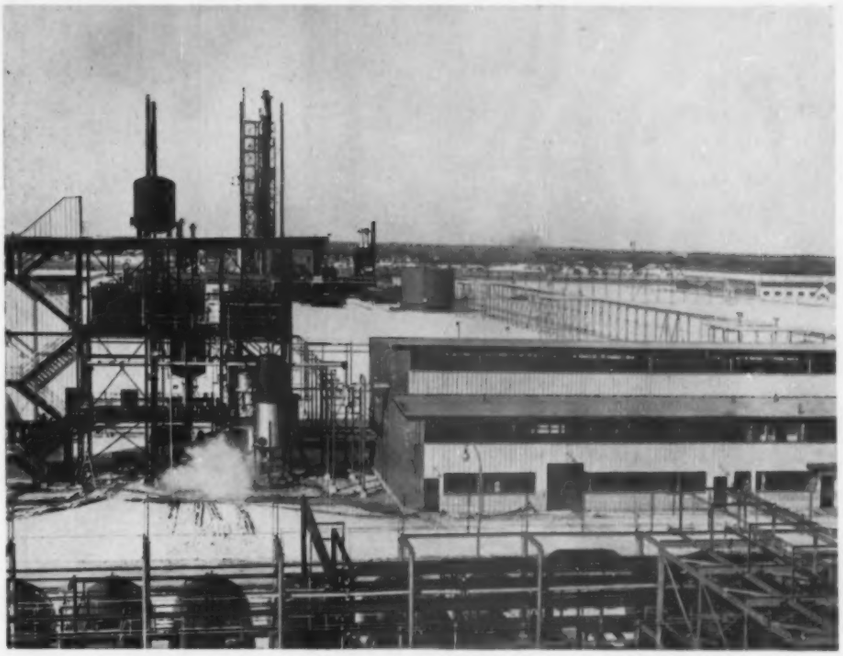
A considerable number of new sulfur recovery plants will be built in Western Canada when the proposed Trans Canada Gas Pipe Line is built. Much of the gas available in the region contains substantial amounts of hydrogen sulfide which must be removed before being placed in the line. Principal deterrent to very large production of sulfur is the high freight rate from Western Canada to outside markets. Most of the local market and that which can be reached by water is already supplied, and the world sulfur shortage of a couple of years ago has now disappeared.

In the Sarnia region two new operations were begun last year. The first oil furnace-black plant in Canada was built by Cabot Carbon Co., and Dow Chemical built a new latex plant and expanded its Styron operations.

The year 1953 represented another period of intensive expansion at the Sarnia plant of Dow Chemical of Canada Ltd.

Early Spring of last year saw the start up of a new styrene monomer unit built to meet the larger requirements of Dow's expanded Styron units and the demands of domestic and export markets.

Five types of Styron, the Dow trade name for polystyrene plastic, are now being produced from this monomer at Sarnia. These have been developed by Dow research to meet requirements of manufacturers of plastic articles for specialized characteristics of heat resistance, light stability and medium and high impact strength as well as for general purpose polystyrene.



Latex unit at the Sarnia plant of Dow Chemical of Canada Ltd. Reactor structure is at left and finishing building at right.

Production from the styrene monomer unit was also earmarked for a synthetic latex unit, construction of which was announced at the time styrene went on stream. Although it was not expected that this unit would be completed until early 1954, good construction weather and other factors combined to make it possible to start the unit up in December 1953, six weeks ahead of schedule.

Dow has long been a leader in developing synthetic latex for many industrial uses. Latex paints, which have no unpleasant odor, are easy to apply and are fast drying, have found wide consumer acceptance on the Canadian consumer market. The paper industry is now producing latex-coated papers which are finding ready acceptance by the printing trade where quality printing is required. Latex is being used by the textile industry in base coats for artificial leather, oilcloth, painted floor coverings, linoleum and as an efficient binder for such fibrous materials as cotton, wool, glass, rock wool and similar materials.

In July of last year, plans were announced for increased production of anhydrous ammonia at Sarnia. Six months later, in January of this year, plans were finalized and a contract let to construct a $3 million addition to the existing ammonia unit. Completion of this expansion will increase Dow's ammonia production to over 100 tons a day, sufficient to meet the present demands of all of Canada.

Refinery still gases are supplied to Dow by Canadian Oil Companies Ltd., Sun Oil Co. and Imperial Oil Ltd. refineries at Sarnia. Refiners also supply raw materials for the Polymer Corp Ltd. synthetic rubber plant built during World War II.

Polymer Corp. is a government-owned company with a plant investment of some $65 million which produces Buna S, Buna N, Butyl, high styrene and cold rubbers as well as latex. Adjacent chemical plant operated by Dow Chemical is supplied by Polymer with by-product ethylene, butanes and surplus styrene. Some materials will also be shipped to Monsanto Canada Ltd., which is erecting a new polystyrene plant at Montreal.

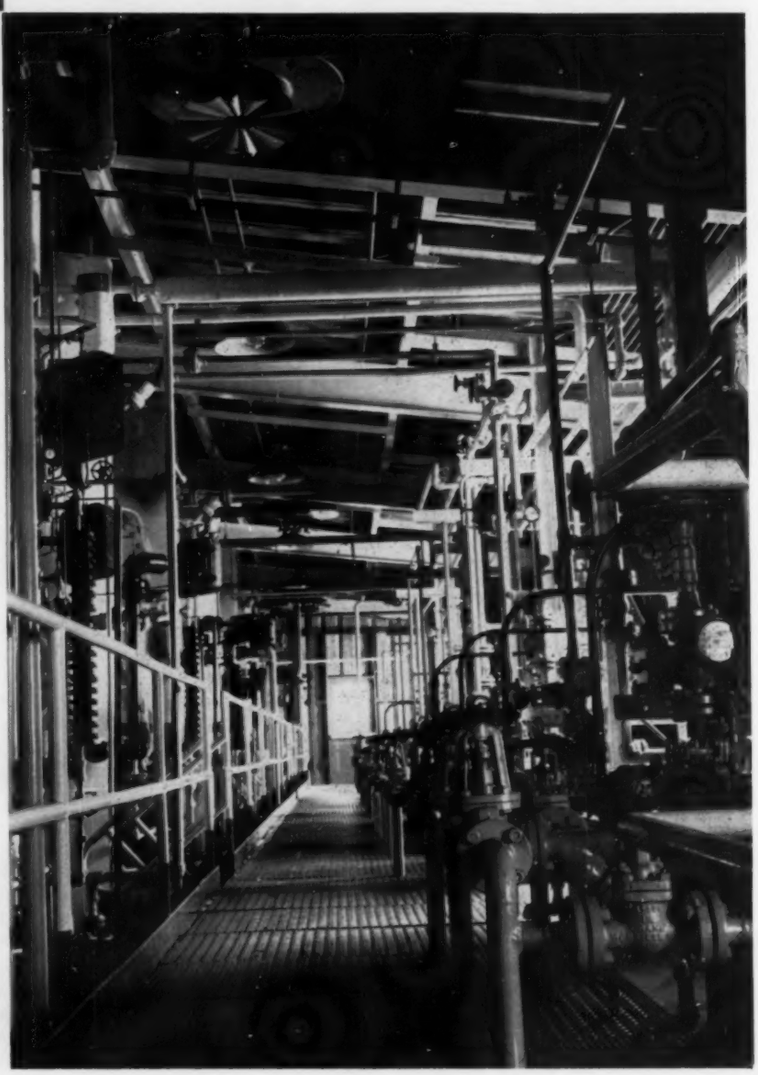
Canadian Industries Ltd. is processing cyclohexane at Maitland, Ont., to produce nylon intermediates. Cyclohexane is obtained from oil refinery producers in the United States. A nylon spinning plant is located at nearby Kingston, Ont. In this same area, Imperial Chemical Industries of Canada Ltd. is erecting a synthetic fiber plant at Millhaven which will process para-xylene. The plant will have cost some $20 million when completed in 1955.

Three important petrochemical plants activated at Montreal were Shell Oil Company's alcohol plant, B-A Shawinigan's phenol plant and Dominion Tar and Chemical Company's ethylene plant. All are based on refinery still gases.

Shell's alcohol plant is designed to produce 20 million pounds per year of isopropyl alcohol and acetone. In this operation propylene is reacted with sulfuric acid and hydrolyzed to form isopropyl al-

Ethylene unit at the Sarnia plant of Dow Chemical of Canada Ltd.

Interior view of Girdler unit at Canadian Chemical Co. plant, Edmonton.



cohol. Acetone is produced by catalytic dehydrogenation.

The B-A Shawinigan phenol plant is the first commercial unit in the world to employ the Hercules process of producing phenol and acetone from cumene. Plant output of phenol is enough to supply Canada's domestic needs. The process involves the oxidation of cumene to form cumene hydroperoxide followed by catalytic reduction to finished products. Cumene for the plant is produced from propylene at the British-American refinery and benzol from Shawinigan Chemicals Ltd.

Ethylene glycol and ethlyene oxide are principal products of the Dominion Tar and Chemical Co. petrochemical plant at Montreal. Still gases for ethylene recovery are supplied by Shell and McColl-Frontenac refineries. A unique low-temperature process is employed for ethylene concentration. Temperatures as low as —260°F are attained by means of gas expansion and heat exchange.

A small detergent plant is operated at Quebec by Vosco Industrial Chemical Products Ltd. The company is processing alcohols and dodecyl benzene.

Future expansion of petrochemicals in Canada may well center on the Prairies, where huge natural gas reserves have been developed. To prepare for gas transmission to domestic markets it will be necessary to greatly increase the number of sulfur removal and natural gasoline plants.

Oil from the Silent World

UNDER THE WARM WATERS OF THE PERSIAN GULF a team of ' aqua-lung ' divers led by Commandant Cousteau—famous underwater explorer—is helping Anglo-Iranian's search for oil.

These men, swimming like fish over the seabed, can explore its geology more closely than has ever before been possible.

Soon, oil from under the sea may be added to the 400,000 barrels per day which flow through Anglo-Iranian's refineries in seven countries. Meanwhile the search for more oil continues from Papua to Nigeria as Anglo-Iranian products spread heat, light and power across the world.

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF

Anglo-Iranian Oil Company
LIMITED

La Quinta Alumina Plant, foreground. San Patricio reduction plant, background.

Alumina plant consumes 60 million cubic feet of gas daily

A FEW MILES ACROSS the bay from Corpus Christi, Texas, a formerly undisturbed piece of Bayfront wilderness has undergone a drastic change during the past three years. Reynolds Metals Co. has built two great industrial plants there on a 1,700-acre site. One of these, a half-mile inshore, is the San Patricio reduction plant, producing metallic aluminum. The other, extending down to the water's edge, bears the name La Quinta. It is the nation's newest and most modern alumina plant.

The Texas Gulf Coast possesses several inherent advantages for aluminum producers. It is close to ore, and an abundant source of primary energy is available in the area in the form of natural gas: the two plants consume some 60 million cubic feet of natural gas per day for the production of electric power. Also, caustic soda, one of the raw materials used in separating alumina from bauxite, is produced in ample supply throughout the Gulf region.

As a fully integrated producer of pig aluminum, one of three in the United States, the plant processes some 730,000 tons of bauxite a year, 2,000 tons a day. The bauxite is converted to alumina at the rate of 1,000 tons per day. To get this production, $40 million was invested in the new facilities at La Quinta. Reynolds furnished the process knowhow. C. F. Braun & Co., vested with single responsibility for the entire project, did the engineering, design, material-procurement and construction.

The La Quinta-San Patricio industrial complex has the distinction of being the only aluminum processing center in the United States where bauxite ore is delivered by ocean-going ships and is then converted to pig aluminum without overland shipment.

Reynolds' oreship, the "Carl Schmedeman," one of a fleet of ore carriers, makes the 1,000-mile run from Jamaica oil fields to the long concrete pier at La Quinta in three days.

In the bauxite grinding facility, the ore is fed to rod mills where it is wet-ground into a slurry. A caustic soda solution added at this point starts dissolving the aluminum oxide from the ore.

This bauxite slurry goes next to the digesters. In these tanks a hot caustic soda solution is mixed with the bauxite under pressure. The alumina in the bauxite reacts with the caustic soda to form sodium aluminate. What's left is iron oxide, which is not dissolved but goes into the residue as "red mud." Pressure reduction and steam removal take place in flash tanks.

Next tne digester effluent travels to the red mud separation area. Here most of the red mud settles out in tanks specially designed for the purpose.

The sodium aluminate solution is diluted and then passed through cotton filters under pressure to get rid of the last traces of iron oxide. Dilution is necessary because the hot alkaline solution would otherwise cause excessive deterioration of the filter screens.

After filtration and heat exchange, the sodium aluminate goes to the precipitation facility. There, in 85 tremendous tanks, a seed charge of aluminum hydrate is added to the rich sodium aluminate liquor. These vessels hold 22 million gallons, 100,000 tons, of fluid under continuous air agitation. About one half of the aluminum precipitates as aluminum trihydrate within a day or two. The clear spent liquor left after precipitation is concentrated in a battery of multi-stage evaporators and then recycled to the digesters.

A series of hydrate thickeners and wash tanks concentrate the precipitated aluminum trihydrate. A new seed charge is drawn off at this point. Eight large dewatering filters then remove much of the remaining water, for in this filtering operation it's the cake that contains the alumina. The filter cake enters four rotary calcining kilns which operate at above 2,000°F. Each kiln's throughput is some 450 tons of calcined alumina per day. After cooling, the alumina goes to storage in an enormous silo accommodating 6,000 tons of finished product.

Alumina must necessarily be highly refined. It usually contains less than 0.2 percent impurities. This is a notable accomplishment, since the bauxite to begin with contains around 50 percent impurities.

This most modern of alumina plants is the first designed and built in the United States by an independent engineering company. La Quinta's facilities incorporate the latest technological developments in materials handling, in processing and in automatic control. As a result, manpower requirements per ton of product are reported to be the lowest in the country.

The La Quinta plant as a whole extends over 400 acres, while its main process

(Continued on page 172)

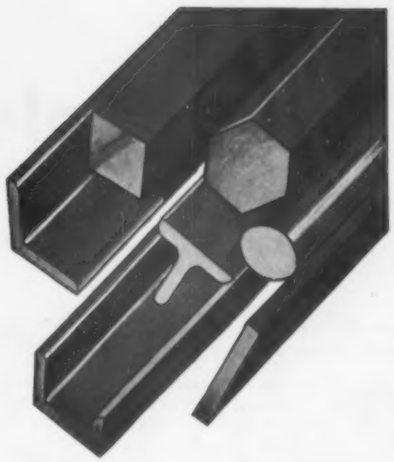
BARNES & BELL LTD.

79, St. GEORGE'S PLACE, GLASGOW, C.2.

Phone: CITY 7911 (5 lines)
Cables: Barbell - Glasgow
Codes A.B.C. (5th and 6th Ed.) Bentley (2nd)

ALSO AT

COATBRIDGE & BIRMINGHAM



Stockholders & Exporters of:—

NEW IRON and STEEL BARS, SECTIONS and PLATES, BOLTS, TOOLS, NAILS, etc.

•

SLEEPERS and RAILS of all kinds
STEEL ARCHES and CORRUGATED STRAPS or BANK BARS for TUNNEL WORK and COLLIERY USE.

•

BUYING AGENTS

•

Mining Supplies of all Descriptions

•

TRENDS

in petroleum refining patents

By Felix Heinemann
and Heinz Heinemann

THIS, THE SECOND annual review of petroleum refining patents to be published in WORLD PETROLEUM, covers the period from May 1953 through April 1954. In view of the several thousand petroleum refining patents which have appeared in this time, it can do no more than attempt to sketch trends in development and thinking of the industry without any claim to completeness. Selected fields of interest have been treated in more detail in the November 1953 and February, April and June 1954 issues of WORLD PETROLEUM. To avoid repetition, reference to these patent reviews will be made in the appropriate places in the current article which also brings them up to date and covers subjects not treated in the interim.

Catalytic Reforming and Dehydrogenation

A total of ten new reforming processes have been announced in the last few years, all of which are being commercialized. This expression of major interest on part of the industry is also reflected in the increasing number of patents issuing in this field, which has grown more rapidly during the last year than any other reviewed here. A review of recent reforming patents was published in the November 1953 issue of WORLD PETROLEUM. A large number of patents has issued even since then, some of which will be discussed in the following.

Universal Oil Products Company leads the field in the number of patents issued. Haensel and Schmerling in 2,658,028 describe the manufacture of a catalyst by treating gamma alumina with at least 60 percent carboxylic acid, after which alumina is precipitated as a gel by hydrolysis. The gel is impregnated with platinum and halogen and is formed and dried. Several U.O.P. patents deal with operational features. A method of distributing catalyst over several reaction zones on the basis of the temperature drops encountered is disclosed in 2,654,694 (C. V. Berger and D. D. Hansen), while a method of cycling catalyst in and out of a reactor and through an intermediate heating zone to reduce temperature gradients and reduce the number of reactors and heaters is described in 2,643,214 (K. T. Hartwig). Two different procedures for two-stage reforming are discussed by V. Haensel and C. G. Gerhold. In 2,664,386 naphtha is first hydrocracked over platinum-alumina-fluoride at 600-1,000°F, 500-1,200 psi, a space rate of 0.2-5 and hydrogen to oil molar ratio of 2-10. The effluent is then dehydrogenated over platinum-alumina at 800-1,100°F, lower pressure (50-700 psi) and higher space rate (2-20) than in the first zone. In 2,65C,692 a naphtha fraction is distilled into two parts which are reformed separately. The lower boiling fraction is subjected to more severe conditions in the presence of a catalyst containing a greater effective concentration of halogen in a platinum-alumina-halogen catalyst than the higher boiling fraction.

The production of alkylated aromatic hydrocarbons is described in two patents by H. Pines and V. N. Ipatieff (2,645,670 and 2,663,746 to Universal Oil Products Co.). Aromatics are produced from substituted cyclohexane hydrocarbons having no fused rings and one geminal C atom. The alkyl aromatic has one more substituted nuclear C atom than the feed. 1,2,3,4-tetramethylbenzene may be obtained from pinane by dehydrogenation and isomerization at 250-425°C over a platinum catalyst in the presence of 1-5 percent of an alkyl halide.

Several patents to other companies deal with the manufacture of platinum reforming catalysts. According to F. G. Ciapetta (2,651,598 to The Atlantic Refining Co.) a silica-alumina cracking catalyst is base exchanged with an alkali (0.5-4 wt. percent) and then impregnated with platinum. The base exchange procedure modifies the catalyst cracking function. L. Heard and M. J. Den Herder (2,659,701 to Standard Oil Co. of Indiana) commingle a platinum compound with a solution of a sulfide of a nitrogen base and then impregnate alumina with the stable platinum solution. E. W. Ribleff, W. P. Burton and P. A. LeFrancois (2,662,-861 to M. W. Kellogg Co.) prepare a platinum or palladium catalyst by decomposing a compound of the metal on a support in the presence of an activating agent consisting of mercury, zinc and cadmium or their compounds by calcination at 400-1,500°F. W. R. F. Guyer, J. P. Thorn and E. Arundale (2,667,461 to Standard Oil Dev. Co.) mix crystalline activated alumina with aqueous hydrogen fluoride (HF) to form a paste containing 0.25-3 percent HF. After permitting the mixture to stand and react, the paste is dried and mixed with enough of a solution of a platinum compound to form a paste containing 0.1-2 percent platinum on alumina. This paste is treated with hydrogen sulfide to uniformly distribute the platinum and is dried, calcined and reduced.

Regeneration of platinum catalysts is the subject of 2,664,404 (L. J. Blatz and R. C. Brandon to Standard Oil Dev. Co.). Catalysts which have been deactivated by hydrocarbonaceous deposits are regenerated by contact with an inert gas containing 2-6 percent oxygen at temperatures of about 700°F and not above 1,100°F to prevent oxidation of the metal. No reduction step is required before re-use.

Chromia-containing reforming catalysts are the subject of several patents. Three Socony-Vacuum Oil Company disclosures discuss promoters. W. H. Lang and C. L. Gutzeit reform naphtha at 975-1,025°F, 400-600 psi and 3-6 H_2/oil mole ratio over a catalyst consisting of 10-35 percent chromia, 0.2-1.5 percent fluorine and an amphoteric metal consisting of tin, antimony or bismuth in specified amounts on alumina (2,645,605). In 2,658,858 the same inventors mix undried, hydrous chromia with moist, undried hydrous iron group metal oxides in proportions such that the final catalyst will contain Cr_2O_3:Fe_2O_3 in a ratio between 40:60 and 70:30. L. C. Drake and R. L. Smith (2,658,-931) add to chromia minor proportions of an alkali metal chromicyanide which is then thermally decomposed in an oxygen-free atmosphere.

Reforming catalysts containing 10-30 mole percent chromia, 50-90 percent alumina and 1-30 percent antimony oxide along with 0.1-5 mole percent of an oxide of gallium, cadmium, thorium and zirconium are described in 2,668,-142 (H. A. Strecker and H. M. Stine to Standard Oil Co. of Ohio). A stabilized molybdena-alumina catalyst containing silica is employed in reforming naphthas by L. V. H. Beckberger and R. C. Woerner (2,661,320; 2,661,383 to Sinclair Refining Co.). Between 0.001 and 0.2 percent oxygen is added to the hydrogen stream entering the reactor.

Two Standard Oil Development Company patents (2,656,304, R. E. MacPherson and O. Schricker; 2,651,597, E. C. Corner and F. B. Fischl) give information on features of fluid hydroforming. Temperatures of 875-950°F and pressures of 450-1,000 psig are used and a gas stream containing 55-90 percent hydrogen is charged at a rate of 5,500-7,500 cu. ft. bbl of oil.

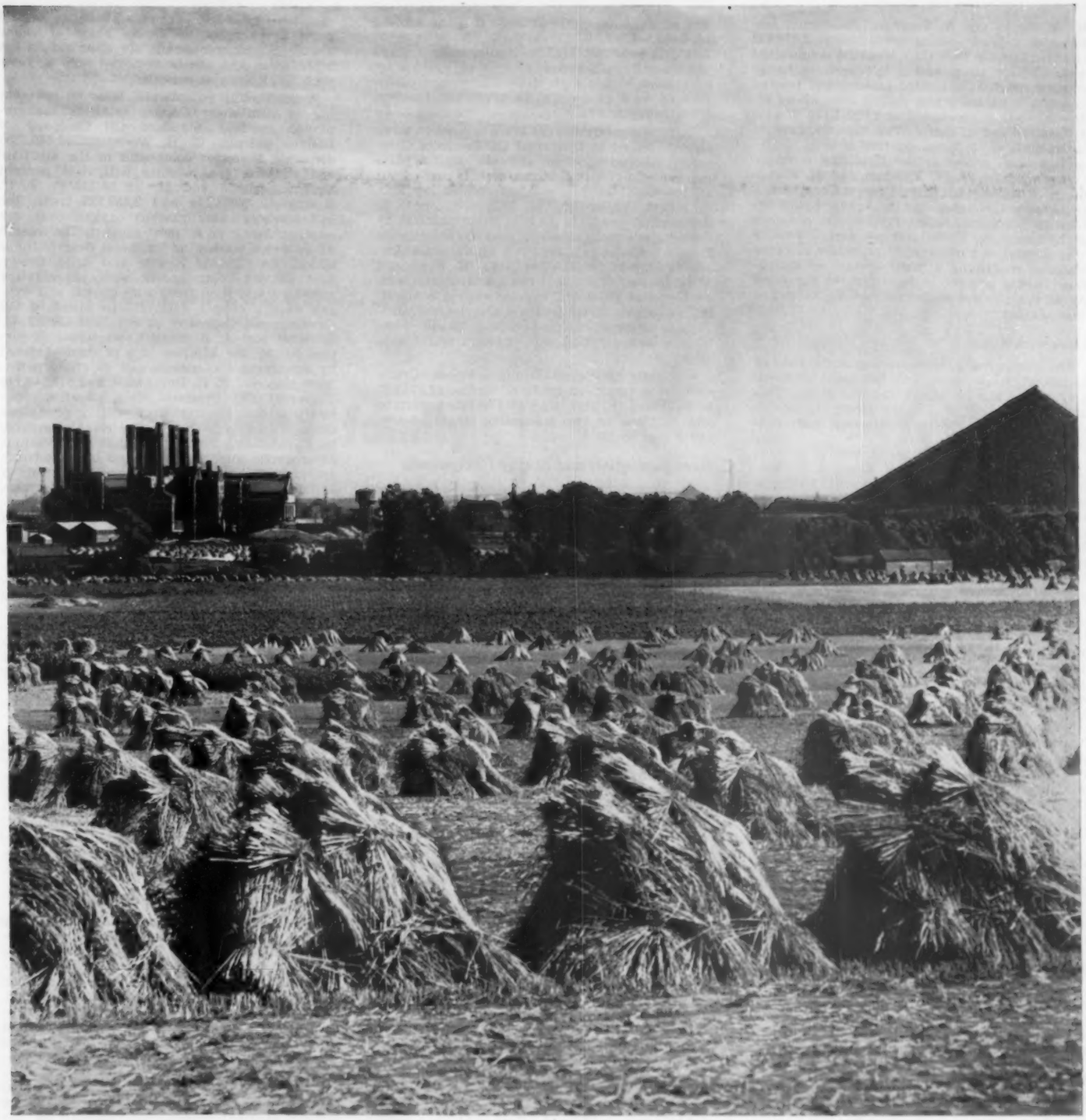
A process for dehydrogenating butane over a chromia-containing catalyst in a dense fluidized bed containing 8-12 parts of catalyst per part by weight of butane is disclosed in 2,672,-490 (B. E. Roetheli to Standard Oil Dev. Co.).

Catalytic and Thermal Cracking

A review of patents in this important field has recently appeared in the April 1954 issue of WORLD PETROLEUM. The patents discussed below supplement those reviewed earlier and bring the earlier article up to date.

Preparation of a steam stable cracking catalyst is described in 2,673,188 (R. E. Schexnailder to Standard Oil Dev. Co.). An anhydrous aluminum alcoholate solution is hydrolyzed with a silica hydrogen containing at least 90 percent water. Hydrous alumina is precipitated in the silica hydrogel containing at least 90 percent Ground gel powders of improved uniformity in size distribution can be prepared according to H. A. Shabaker (2,669,547 to Houdry Process Corp.) by incorporating a minor proportion of dry, powdered gel into a hydrosol. After setting, the resulting gel is structurally weak and can easily be pulverized to the desired size. The gel particles incorporated into the solution have the average size range desired for the final product and a particle size of at least two microns. The regeneration of aged, iron poisoned silica-alumina cracking catalysts is discussed by H. M. Stine in 2,673,187 (to Standard Oil Co. of Ohio). Beryllia, in amounts of less than 1 percent, is impregnated on the catalyst and reduces the severity of regeneration and the loss of feed stock due to oxidation.

Houdry Process Corporation patent 2,669,540 (W. W. Weinrich) is concerned with a moving bed cracking unit and a method of guiding catalyst particles to a storage vessel after they have been disengaged from the lift gas on top of a catalyst lift. A method of lifting catalyst from the bottom of a lower reactor to the top of a higher reactor through a series of descending and ascending legs is described in 2,676,142 (J. A. Crowley to Socony-Vacuum Oil Co.).



"In this age, all nations look to industrial development as an important means to national strength and better living standards for their peoples. But important as it is, industrial development must not be allowed to get out of balance with agriculture and other elements of the economy. Pushing industrial development at too fast a pace can disrupt agriculture and foreign trade dependent on it."

ESSO

STANDARD OIL COMPANY (NEW JERSEY)

AND AFFILIATED COMPANIES

R. W. Krebs and A. Voorhies, Jr. discuss features of a fluid coking operation in 2,670,322 (to Standard Oil Dev. Co.). Naphtha is contacted with olefinic gases and a hydrogen exchange catalyst, such as activated carbon, and treated naphtha is passed into a coking zone where reduced crude is converted at 1,050-1,150°F with a fluidized bed of inerts. The naphtha, present in amounts of 50-75 vol. percent of total hydrocarbon feed, serves as the fluidizing medium.

A. G. Oblad, T. H. Milliken and H. Heinemann (2,676,907 to Houdry Process Corp.) crack predominantly non-aromatic heavy hydrocarbons to lower boiling material in the presence of hydrogen at 1,000-3,000 psi and 700-900°F over a catalyst consisting of an acidic siliceous material containing a small amount of molybdena, which amount is dependent on the acidity of the catalyst as determined by its quinoline number.

Isomerization

The number of patents issuing in the field of hydrocarbon isomerization has gone through a cycle and is now on the upswing again. This is at least partially due to the interest in catalytic reforming of which isomerization is an integral part.

In two Shell Development Company patents (2,668,790 and 2,668,866, G. M. Good, J. W. Gibson and B. S. Greensfelder) supported platinum catalysts, similar to those used in reforming, are employed for the isomerization of paraffin waxes to produce normally liquid lube oils. The reaction is carried out in either liquid or vapor phase at 300-500°C and pressures up to 3,000 psi and in the presence of at least one mole of hydrogen per mole of wax.

Isomerization of lower mono-olefins is discussed in a number of patents. 2,2,3-trimethylpentenes are converted to 2,3,3- and 2,3,4- trimethylpentenes over silica containing 0.1-10 wt. percent alumina and 0.01-10 wt. percent of an oxide of nickel or cobalt (2,653,981, J. P. Hogan to Phillips Petroleum Co.). Reaction temperatures of 75-175°F are employed at 1-50 atm. pressure. F. E. Condon (2,666,798 to Phillips Petroleum Co.) uses elemental iodine in an amount of 1-15 wt. percent to isomerize olefins at 125-250°F and sufficient pressure to maintain liquid phase. Magnesia, having an iodine value of at least 30, is the catalyst employed by A. C. Zettlemoyer and W. C. Walker (2,666,771 to Food Machinery and Chemical Corp.).

A process for the thermal isomerization of alkyl aromatics, having more than two C atoms in the side chain is disclosed in 2,671,120 by V. N. Ipatieff, H. Pines and B. Kvetinskas (to Universal Oil Products Co.). The reaction is carried out at 400-525°C and at least 3,000 psi at a liquid hourly space rate of 1-1.5 V/V/Hr.

Alkylation

While the number of new patents on alkylation is still small, the interest in alkylation as a means of making paraffinic high octane gasolines and alkyl aromatic chemicals is reflected in some significant new procedures.

In Sun Oil Company patent 2,653,982, R. M. Kennedy and C. K. Donnell react an isoparaffin and an olefin at —120 to +150°C with a catalyst prepared *in situ* and consisting of an admixture of BF_3 with an alkyl fluoride having at least two C atoms/mole in a ratio of between 1 and 10 moles. Toluene and xylene are alkylated at 40-70°C and atm. pressure with an isoparaffin of at least five C atoms and one tert. H atom over a catalyst of $AlCl_3$ and tert. butyl chloride made *in situ* (R. M. Kennedy and A. Schneider, 2,673,224 to Sun Oil Co.). In the same company's patent 2,668,865, A. Schneider alkylates an alkyl substituted cyclopentane with an isoparaffin having 4-6 C atoms and at least one tertiary H atom. The components are contacted with HF catalyst at —10 to 100°C in the presence of an olefin which acts as a hydrogen acceptor. Polyalkyl cyclohexane is produced.

Hydrogen fluoride is used as a catalyst in a group of Phillips Petroleum Company patents. Alkylation of isopentane with a lower olefin at 100-200°F in a combined reaction-fractional distillation zone is described in 2,662,103 (M. P. Matuszak). Simultaneous alkylation of an aromatic nucleus with an isoparaffin of 4-20 C atoms and an aliphatic olefin at 20-30°C is the subject of 2,653,980 (F. E. Condon). W. A. Schulze in 2,645,672 produces high molecular weight alkyl benzenes from benzene, toluene or xylenes by alkylation with a high molecular weight olefin present as a component in a product fraction from catalytic cracking.

Different catalyst types are disclosed in three patents issued to Universal Oil Products Company. Alkylation of an aromatic with a polymeric olefin of 6-18 C atoms/mole is carried out at 100-400°C over a catalyst comprising B_2O_3 $(H_3P_2O_4)2$, (2,652,434, W. W. Johnstone). L. Schmerling prepares an alkylation catalyst by reacting one mole of phosphorus oxyhalide with from 1-2 moles of anhydrous aluminum chloride at —30 to 150°C (2,646,452). H. Pines and V. N. Ipatieff (2,670,390) react an aromatic with an olefin at 125-275°C over a catalyst comprising an alkali metal and an acetylenic hydrocarbon. Propylbenzene is thus made from toluene and ethylene over sodium and 1-heptyne.

A slightly hydrocarbon-soluble Friedel-Crafts catalyst is employed by R. S. Marme (2,674,637 to Standard Oil Dev. Co.) to alkylate isobutane and ethylene in two successive stages at 130-140°F and 95-105°F.

Desulfurization and Sulfur Compounds

The importance of sulfur compounds in petroleum products has long been recognized and sulfur compound removal from gasolines in particular has been an active field for many years. With the increasing reliance on catalytic processes and the sensitivity to sulfur of many catalysts, sulfur removal from heavier fractions is getting more recognition. The activity in this field is apparent from the fact that more patents dealing with removal of sulfur compounds in petroleum have issued during the past year than on any other processing step covered in this review.

Almost complete removal of all types of sulfur compounds can be obtained by catalytic hydrogenation and subsequent removal of H_2S. Hydrodesulfurization was discussed in a patent review in WORLD PETROLEUM of November 1953. Since then, additional patents have issued to Anglo-Iranian Oil Company on their Autofining process. Patents 2,648,623; 2,656,302 and 2,672,433 (F. W. B. Porter, R. P. Northcott and J. Rowland) are concerned with features of a hydrodesulfurization process, which also causes enough naphthene dehydrogenation to supply hydrogen requirements. Cobalt molybdate catalyst is employed at 750-800°F at 50-250 psi pressure. The catalyst may be pretreated by sulfiding it. Catalytic hydrodesulfurization of a naphtha over a cobalt molybdate or other sulfur resistant catalyst prior to catalytic reforming over a platinum catalyst is described in 2,671,754 (A. J. de Rosset and C. H. Watkins to Universal Oil Products Co.).

Sulfur removal by an extraction treatment is covered in a group of Standard Oil Company of Indiana patents. R. C. Arnold and A. P. Lien use liquid sulfur dioxide (SO_2) and either aluminum chloride, boron trifluoride or sulfur trioxide as solvents. In 2,646,390 a heater oil distillate, containing 0.6-1.5 percent sulfur is extracted at —20 to —40°C with 0.5-3 g. moles of Al Cl, per g. atom of sulfur in the presence of enough liquid SO_2 to form distinct raffinate and extract phases. In 2,671,046 and 2,671,047 one to three moles of boron trifluoride per g. atom of sulfur are used in liquid SO_2 to extract organo sulfur compounds at 0 to —85°C. A mixture of liquid SO_2 and 1-5 percent sulfur trioxide based on hydrocarbon distillate (boiling range 325-575°F) is the solvent proposed in 2,673,830 at 20 to —40°C. The mercaptan content of virgin petroleum distillates is reduced by treatment at 60-125° F with 2-20 lbs./bbl. of an aqueous 85-100 percent solution of sulfuric acid in the presence of sulfuryl chloride and removal of acid sludge (2,651,596, J. H. Krause).

Removal of sulfur compounds by liquid phase treatment of hydrocarbons with a solution of hydrogen fluoride in a chlorofluoro-hydrocarbon at 50-200°F and 100-500 psi is taught in 2,655,463 (A. E. Hoffman to Universal Oil Products Co.). M. L. Kalinowski (2,663,673 to Standard Oil Co. of Ind.) treats petroleum distillates with one part of asphaltenes per 1-6 parts hydrocarbon in liquid phase at below 250°F. Sulfur compounds are absorbed on the asphaltenes and can be removed with solvents such as alcohols or acetone.

A good many patents still issue on sweetening of distillates. Copper catalysts are employed in four Standard Oil Company of Indiana patents. G. H. Weiseman (2,646,389) disperses a copper compound in the distillate and contacts the mixture with 1-15 percent aqueous caustic and air at 80-125°F. J. H. Krause in 2,653,124 and 2,653,125 treats the hydrocarbons with gaseous oxygen over dry cupric chloride on an inert support. The treated oil is water washed and a metal deactivator is added. In 2,663,674 Krause and R. H. Brown first extract color bodies with non-alkaline methanol and then treat with caustic and oxygen over a copper catalyst. In Standard Oil Development Company patent 2,638,439 (J. G. Browder and A. R. Smith) sweetening is carried out by the addition of a product obtained by acidifying the sodium salt of crude petroleum phenols. R. H. Rosenwald in 2,671,048 (to Universal Oil Products Co.) sweetens sour hydrocarbons by treatment with a phenylene diamine and a hydrocarbon soluble organic base consisting of an aliphatic polyamine, heterocyclic nitrogen compound or quaternary ammonium compound in the presence of air at 50-125°F. An organic metal salt and a mercapto-alkylbenzimidazole are used as sweetening agents in 2,674,566 (J. I. D. Osterhout and G. D. Pingrey to The Texas Co.).

Removal of sulfur compounds in hydrocarbons by oxidation to sulfur dioxide at 750-850°F in the presence of cuprous sulfide catalyst is proposed in 2,640,010 (C. O. Hoover to Air Reduction Co.).

Removal of hydrogen sulfide from light mineral oils by treatment with an aqueous solution of an iron salt having a weakly acidic, organic anion and having a solubility in water greater than 10 g/l at atmospheric conditions in described by K. E. Leutz in 2,641,571 (to Sun Oil Co.).

Sulfuration of a mineral lubricating oil is, according to H. E. Sperry (2,669,560 to Sun Oil Co.), carried out in liquid phase at 250-400°F with elemental sulfur in the presence of elemental iodine.

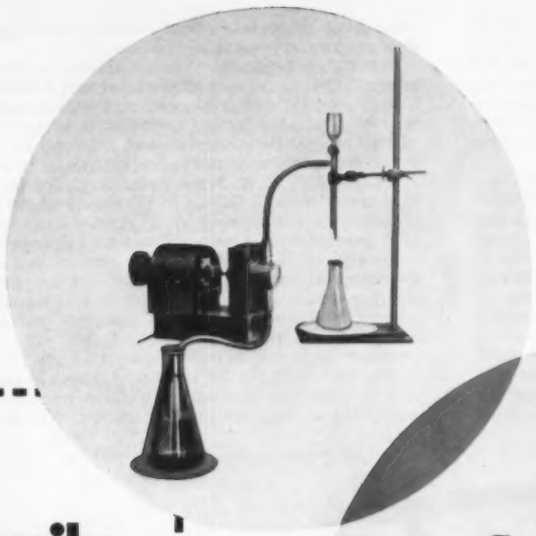
Diesel fuels, containing 0.2-3 percent sulfur can be made non-corrosive without removal of the sulfur compounds by the addition of 0.003-0.5 wt. percent of hydrated calcium nitrate (2,673,145, W. H. Chandler to Shell Dev. Co.).

Refining

In this section are grouped patents for the upgrading, separation and purification of hydrocarbon materials which do not fit into a more specific classification. There is, of course, always a considerable number of patents which must be placed into such a catch-all section. This year, however, there has been a noticeable increase in the number of patents dealing with the separation of closely boiling fractions by extraction, distillation, adsorption or combinations of these.

Color and sludge removal and oil stabilization are treated in several patents. A separate review of hydrocarbon additive patents has appeared in the June 1954 issue of WORLD PETROLEUM. G. R. Bond (2,642,382 to Houdry Process Corp.) admixes oils boiling below 900° F with 0.1-10 vol. percent of an aqueous solution of ferric chloride admixed with a saturated solution of alkaline earth metal chloride to remove color and sludge formers. E. C. Daigle (2,650,187 to Socony-Vacuum Oil Co.) contacts oil with a polyethylene glycol of molecular weight above 600 and complete solubility in water to improve storage stability. According to D. Milsom (2,666,021 to Cities Service Research & Dev. Co.), No. 2 fuel oil from catalytic cracking is stabilized by treating it under sufficient pressure to maintain liquid phase with a catalyst comprising aluminum fluoride.

Methods for dechlorination or dehydrofluorination of hydrocarbons are described in two Phillips Petroleum Company patents. Residual chlorine is removed from reaction products of an aluminum chloride synthesis according to

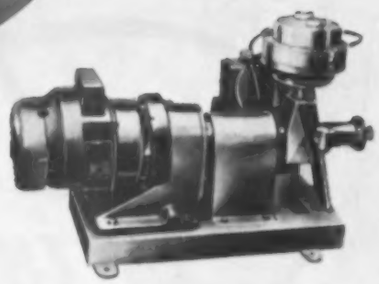


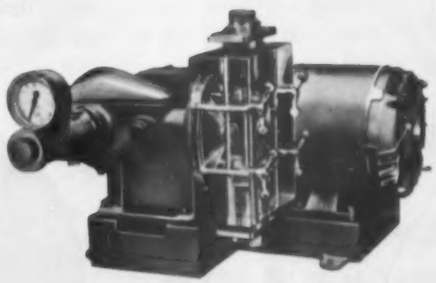
Solenoid-operated plunger pump with variable stroke and speed.

Single-stage gas pump with polytetrafluoro-ethylene diaphragm.

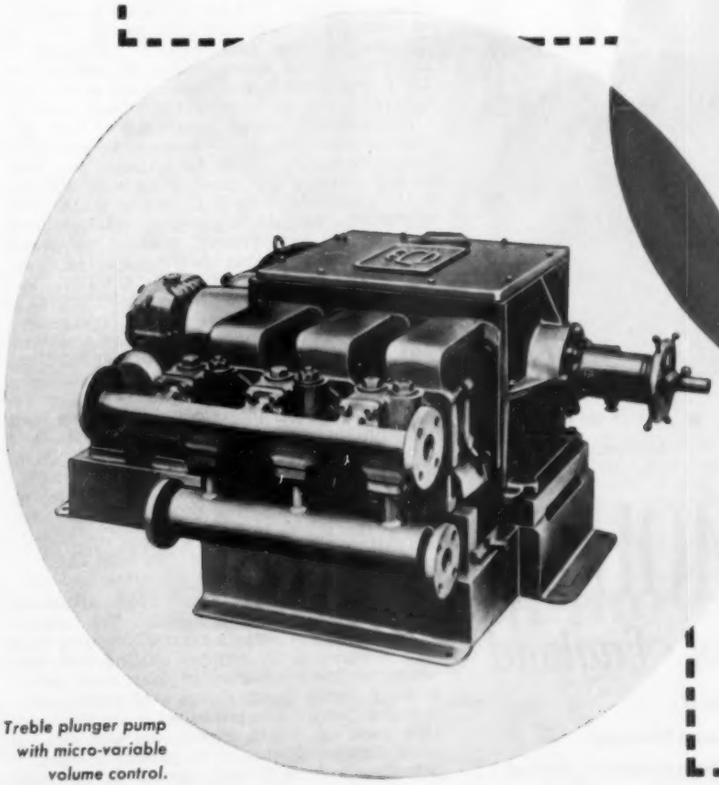
Growing family

The wide range of proportioning and metering pumps that we manufacture for chemical and industrial process fluids is constantly growing. We are regularly developing new types of pumps to meet unusual problems in handling 'difficult' fluids. If you are having trouble with volatile, corrosive or precious fluids, why not let us help you?





Diaphragm pump micro-capacity control with dial-type stroke adjustment indicator.



Treble plunger pump with micro-variable volume control.

E. C. D.

Proportioning and metering

PUMPS

E.C.D. Limited, Engineers, Tonbridge, Kent

Telephone: Tonbridge 2237

H. J. Hepp (2,673,226) by contact with a fluid aluminum chloride-hydrocarbon complex, having a heat of hydrolysis in the range 280-375 cal/g. G. T. Leatherman (2,636,912) separates organic fluorine containing hydrocarbons by distillation in a column containing non-adsorptive carbon aggregates of 0.01-5 m^2/g surface area.

Two Sinclair Refining Company patents are concerned with the refining of asphaltic residues. In 2,650,898 (E. N. Case) asphaltenes and metal contaminants are removed from crude prior to desalting, by saturating the crude at 15-200 psi with gaseous hydrogen chloride and precipitating the contaminants. According to 2,650,897 (R. C. Woerner), asphaltic residua are extracted with butane. Fresh solvent is mixed with raffinate and fresh residue with extract prior to entering the extraction and settling chambers. Foster Wheeler Corporation patent 2,669,539 (J. G. Ditman) gives details on recovering propane without foaming after use in a propane deasphalting process.

Patents on separation can be treated in two groups. One is concerned with solvent extraction. Aromatic and non-aromatic hydrocarbons may be separated by extraction with a fluorocarbon of specific properties and a second solvent such as acetic anhydride, acetonitrile, aniline, etc. (2,663,670, A. W. Francis and G. C. Johnson to Socony-Vacuum Oil Co.). Perfluoro methylcyclohexane is proposed by B. Braae (2,649,467 to Separator-Nobel) as a solvent for hydrogen-rich extracts. The extraction is carried out at a temperature at which oil and solvent are only partly miscible and in the presence of a second solvent, miscible with the oil and only partly miscible with the first solvent. Silver nitrate dissolved in a non-reactive solvent is used by A. W. Francis (2,673,225 to Socony-Vacuum Oil Co.) to separate olefins from fluid mixtures containing at least 15 percent olefins. Extractive distillation processes for separation of saturated and unsaturated hydrocarbons are discussed by Neuhart and Gohlke (2,652,439 to Phillips Petroleum Co.) and Cooper and Medcalf (2,655,467 to American Cyanamid Co.) who fractionate countercurrent to molten phthalic anhydride.

Other methods of separation are adsorption and adsorptive distillation. Martin, Lewis and Herbst in 2,651,603 and 2,665,315 (to Standard Oil Dev. Co.) as well as S. J. Marwil (2,652,437 to Phillips Petroleum Co.) discuss details of this type of operation.

Removal of non-hydrocarbons and under certain conditions, of aromatic hydrocarbons, as a sludge is disclosed by R. M. Kennedy and A. Schneider in 2,639,260-2,639,262 (to Sun Oil Co.) Boron trifluoride and an alkyl fluoride are brought together in the presence of the hydrocarbons to precipitate the sludge.

Recovery of ethylene from cracked gases is the subject of 2,651,666 (C. O. Berg and D. H. Imhoff to Union Oil Co. of Cal.). A moving bed of active charcoal is used to separate ethylene by adsorption from hydrogen and methane.

Catalysts

Preparation of catalysts is intimately connected with the process for which the catalyst is used. Many catalysts have, therefore, already been discussed in connection with specific processes. In the following, mention is made of a few of many catalyst patents which are not restricted to application in one of the processes treated in separate sections.

A group of Universal Oil Products Company patents deals with the preparation of alumina catalysts and supports. V. Haensel in 2,663,620 and 2,667,404 heats aluminum chloride hexahydrate at 225-600°F to liberate a portion of its chloride content. A basic reagent is commingled with the residue to form aluminum hydroxide, which is washed, dried, etc. The $AlCl_3$ solution may be commingled with ammonia in the pipe to a spray drier and contacted in the drier with a gas at a temperature sufficient to evaporate water. L. Schmerling in 2,651,617 treats alumina with an organic acid and then hydrolyzes basic aluminum salts formed. J. Hoekstra (2,666,749) forms spheroidal alumina by making a dispersion of 15-35 percent alumina in water. A solution of ammonium acetate and water is brought to a pH below 8.5 by addition of ammonium hydroxide and mixed with the alumina solution below 110°F. Droplets of the mixture are passed into an oil bath at 120-220°F and retained therein until set to hydrogel spheres which are then aged in a basic medium.

Conversion catalysts consisting of 1-10 percent of chromium, molybdenum or vanadium oxides composited with an intimate and integrated mixture of active silica and titanium oxide are disclosed by J. C. Morrel in 2,670,321. Hydrogenation-dehydrogenation catalysts consisting of 20 wt. percent calcium manganate and 80 percent alumina are the subject of 2,648,-639 (R. B. Bennett to Standard Oil Dev. Co.). L. O. Winstrom and W. B. Harris (2,671,763 to Allied Chemical and Dye Corp.) regenerate a nickel sulfide on alumina catalyst by treatment with an oxygen-containing gas at 300-700°C for a period sufficient to remove carbonaceous materials. The oxidized catalyst is then reduced without an intervening sulfidation step.

Olefin polymerization catalysts and their application are discussed in Standard Oil Co. of Indiana patents 2,677,000; 2,677,001 and 2,677,-002 (L. W. Russum, N. Fragen and J. W. Healy). Aluminum halide-hydrocarbon complexes constitute the active ingredient.

Petrochemicals

Production of chemicals from petroleum hydrocarbons is growing rapidly. The number of petrochemical patents currently issuing is at least as large as the number dealing with processes for the production of fuels from petroleum. A comprehensive review of recent petrochemical patents was published in the February 1954 issue of WORLD PETROLEUM and since a more detailed discussion of patents in specific petrochemical fields will appear in the near

This is the site

FOR YOUR REFINERY OR OIL INSTALLATION IN

the world's second market

Avonmouth is a strategic center for distribution throughout the United Kingdom, second only to the U.S. as an oil importing nation It has unrivalled communications by rail, road, canal and sea.

The Port's 375-acre industrial estate, offering attractive sites on lease, is linked by pipeline with the nearby oil dock.

In 1952, 2¼ million tons of petroleum were handled at Avonmouth. During 1945 imports alone topped 4¾ million tons—a world record.

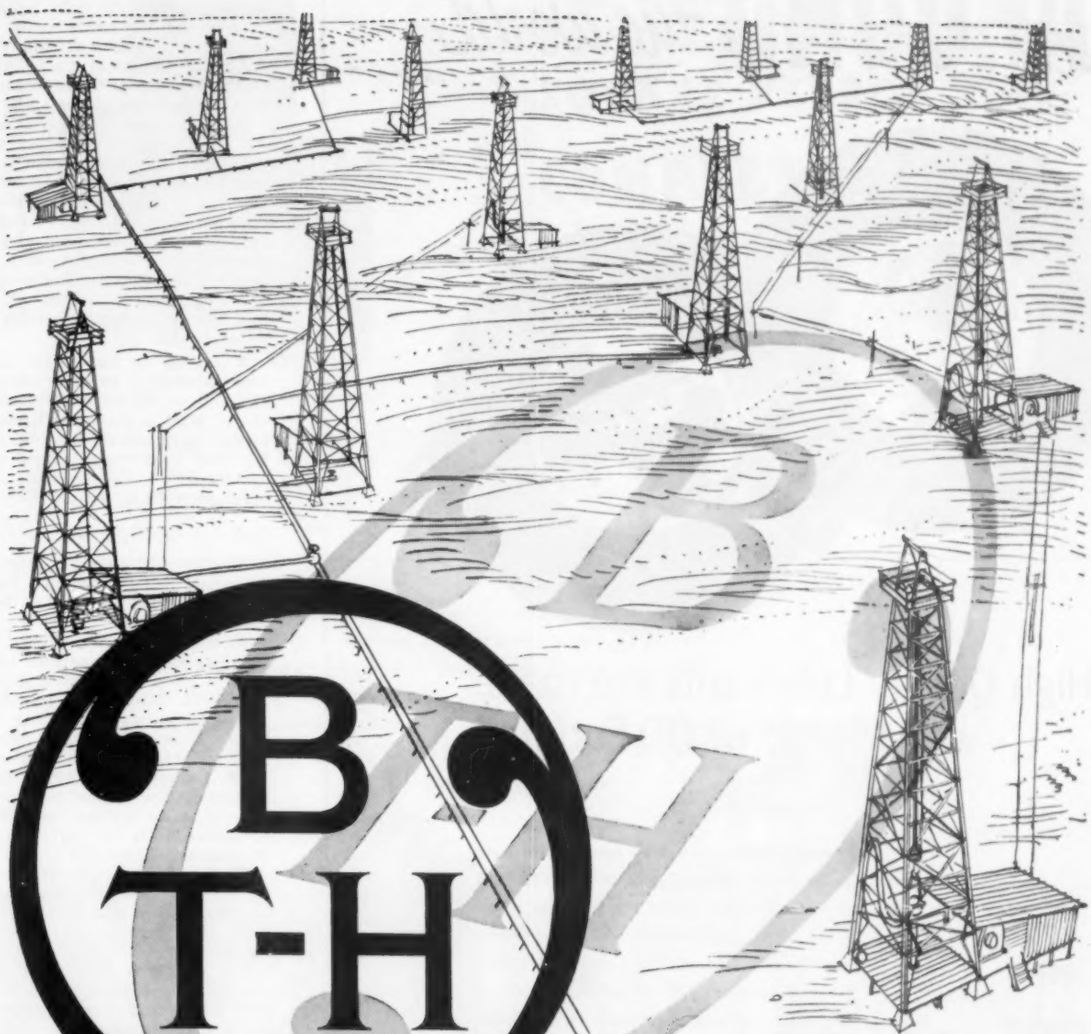
The Royal Edward Entrance Lock is 875 ft. long, 100 ft. wide.

★ Part of the Oil Dock, Avonmouth.

AVONMOUTH

Port of Bristol · England

Enquiries to:
The General Manager,
Port of Bristol Authority, England



B T-H

The symbol on the
Best Electrical Equipment

Hard and continuous service is demanded of any electrical equipment in the oil industry. That is why in the fields so many of the generators, motors, starters, and other devices bear the initials BTH—symbol of sound design and of guaranteed reliability in service.

But this is only one direction in which the specialisation and long experience of BTH have built up an enviable reputation. It is the same in mining, power supply, traction, marine engineering, and general industry—wherever first-class electrical products are needed. With over fifty-four years' experience and eleven factories, BTH can give outstanding service to industry in every sphere of electrical engineering.

THE
BRITISH THOMSON-HOUSTON
COMPANY LTD., RUGBY, ENGLAND

Member of the A.E.I. group of companies.

A4290

AROUND the world

High Quality Lubricants are made with the aid of QO-Furfural*

Petroleum refiners in both hemispheres have discovered the advantages of using QO-furfural as a selective solvent for processing of lubricating oil. The application of furfural results in a safe, low cost, relatively simple operation giving an excellent yield of high quality oil.

QO-furfural insures the user of a reliable, purified product, thoroughly tested by the experience of petroleum refiners in the United States and abroad. QO brand also assures users around the world of low cost furfural from manufacturing units of economic size.

1954 will see use of furfural in 41 petroleum processing units. Most of these are designed for refining of lubricating oil, but other petroleum fractions are being treated successfully with this solvent.

If you would like to know more about furfural and its uses, write to us.

QO OLEAN CHEMICALS

Furfural
Furfuryl Alcohol
Tetrahydrofurfuryl Alcohol
Furoic Acid
Fur-Ag® Conditioner
Furafil® Lignocellulose

*QO-Furfural is a liquid chemical produced by The Quaker Oats Company from agricultural residues.

The Quaker Oats Company
CHEMICALS DEPT.

343M The Merchandise Mart, Chicago 54, Illinois
Room 543M, 120 Wall St., New York 3, N. Y.
Room 443M, P. O. Box 4376, Portland 8, Oregon
In Europe: Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France

future, only a few developments will be listed here.

A process for the hydration of ethylene with steam over a supported phosphoric acid catalyst is disclosed by R. J. Schrader and H. S. Young (2,673,221 to Eastman Kodak Co.). There may be considerable amounts of inert gaseous impurities in the recycle stream, but the free oxygen content is held below 0.2 percent. A catalyst for the oxidation of olefins is claimed in 2,671,764 and 2,671,766 (D. K. Sacken to Jefferson Chemical Co.). Alkali metalsulfate (1.5-3 percent is incorporated as a promoter into a supported silver (2-20 percent) catalyst.

Houdry Process Corporation patent 2,672,477 (H. Heinemann) describes the production of unsaturated organic nitriles from saturated nitriles having two carbon atoms less per molecule by reaction with ethylene oxide over alumina at 300-800°F. Dehydrogenation of saturated to unsaturated nitriles is carried out at 950-1,300°F according to L. V. P. Beckberger (2,671,107 to Sinclair Refining Co.) over a solid dehydrogenation catalyst in the presence of hydrogen cyanide in an HCN to nitrile ratio of at least 1:10.

A process for the direct oxidation of substituted aromatics to acids such as benzoic, toluene and uvitic acids is the subject of 2,673,217 (D. C. Hull to Eastman Kodak Co.). Cobaltous acetate is dissolved in acetic acid and is treated with an oxygen-containing gas while adding acetaldehyde. The aromatic is then blended in together with an excess of oxygen.

Lubricating Oils, Waxes, Greases

The level of patent activity in this field has remained fairly constant. Trends are difficult to spot because so many of the patents describe specific additives.

A combination cracking, fractionation and selective extraction process to produce lube oils from a gas oil feed stock is disclosed in 2,660,-552 (F. H. Blanding to Standard Oil Dev. Co.).

Hydrogenative upgrading of lube oils for color improvement and without substantial hydrogenation of unsaturates is described by W. N. LaPorte (2,654,696 to Sun Oil Co.), while hydrogenative upgrading of waxes over molybdena-alumina calcined at 1,200°F is the subject of 2,658,856 (S. F. Perry and R. M. Bailly to Standard Oil Dev. Co.).

The pour point of paraffinic materials may be lowered by treatment with aluminum bromide at 10-100°C in the presence of a low boiling saturated hydrocarbon, according to 2,645,601 (F. E. Frey to Phillips Petroleum Co.).

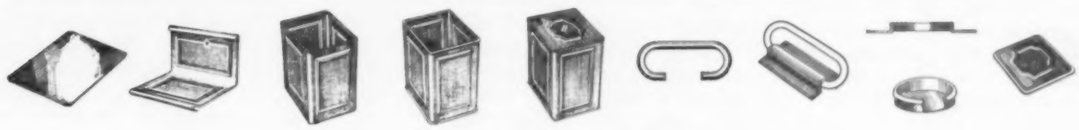
Many patents disclose additives. E. Mitchell (2,654,708 and 2,654,709 to Gulf Res. and Dev. Co.) confers detergent properties on lube oils by incorporating a polyvalent metal salt of a monoamide of a dicarboxylic acid of specific configuration. Rusting of ferrous metal surfaces can be inhibited according to 2,649,416 (F. P. Richter and E. W. Fuller to Socony-Vacuum Oil Co.) by addition to a lubricating oil of a monoester of a thiodiacetic acid of specific formula. Lube oils containing 0.05-20 wt. percent of an oil soluble metal salt of the acidic condensation product of a hydrocarbon substituted phenol and a vinyl compound are patented by L. L. Neff in 2,656,316 and 2,656,317 (to Union Oil Co. of Cal.). Production of a lubricating grease from an oleaginous liquid by incorporation of 5-45 wt. percent of a precipitated hydrated calcium silicate having a particle size of not more than 100 millimicrons is claimed by G. W. Eckert (2,656,315 to The Texas Co.).

Extraction and dewaxing treatments are discussed in numerous patents. An extraction of lube oil with urea at below 150°F in the presence of water and a C_7-C_{11} normal paraffin is disclosed in 2,666,020 (G. B. Arnold, H. V. Hess and J. K. Truitt to The Texas Co.). Solvent dewaxing is the subject of 2,667,447 (Perry, Engisch and Marriner to Standard Oil Dev. Co.), 2,654,693 (C. F. Sacra to Shell Dev. Co.), 2,654,692 (Kiersted and Gross to Texaco Dev. Co.), while wax separation is discussed by H. A. Kirsch, W. E. Skelton and W. V. Overbaugh in 2,653,123 (to The Texas Co.) and by D. A. Hermanson in 2,674,564 (to Socony-Vacuum Oil Co.).

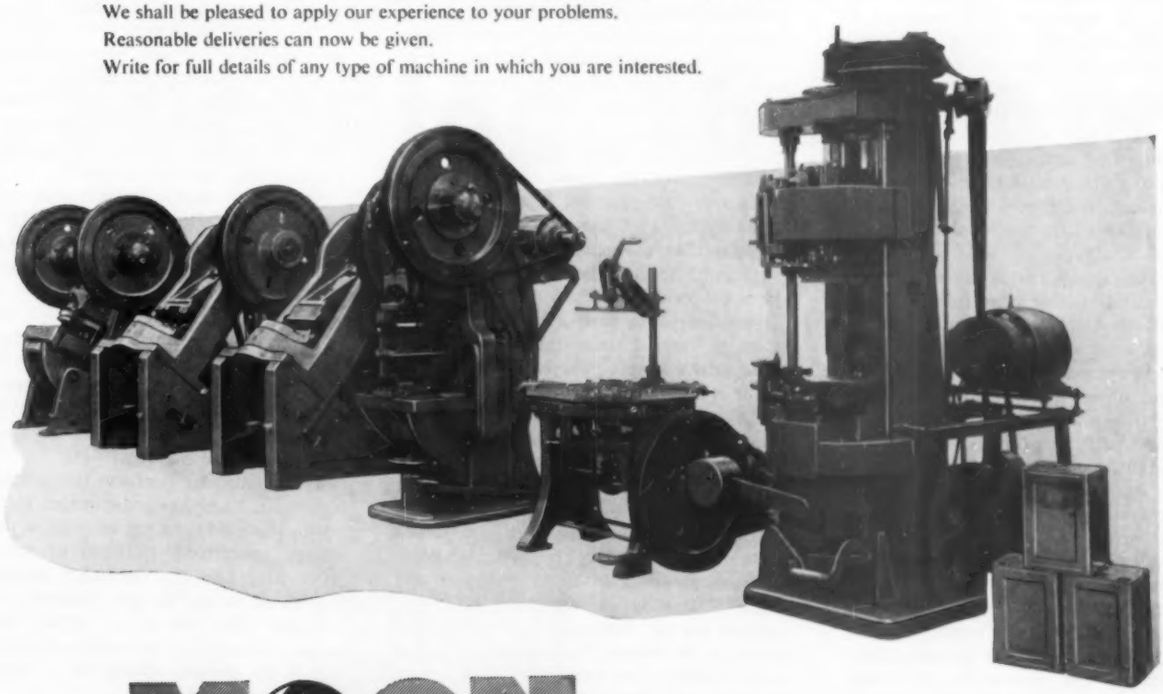
4 GALLON (IMP.) OR FIVE GALLON (U.S.A.) SQUARE PETROL TINS

COMPLETE PLANT

for High-Speed Continuous Production



The battery of machines illustrated below effects all operations, from the sheet to the finished petrol tin. MOON Machines provide speed of output and quality of finish and embrace all operations in metal box or drum manufacture. We shall be pleased to apply our experience to your problems. Reasonable deliveries can now be given. Write for full details of any type of machine in which you are interested.



MOON

Regd. Trade Mark

LONDON OFFICE: Abbey House, 2/8 Victoria Street, S.W.1
Cables: Moonbro, Sowest, London, England

MOON BROTHERS LIMITED · BIRKENHEAD · ENGLAND · *Cables: Moonbro, Birkenhead, England*

MAKERS OF TIN BOX AND DRUM MAKING MACHINERY

dm MB74

Refinery Waste Disposal

(Continued from page 108)

are broken into water and oily phases by one or more of the following treatments: heat, distillation, precoat filtration through a layer of diatomaceous earth, biological filtration through rock-filled filters, floculation, ozonation, and electrical separation using a high-potential pulsating unidirectional current. The latter method is used in the dehydration and desalting of crude oil. Electrical desalting also is used for treating tank-bottom and slop-oil emulsions by blending them along with the regular crude charge.

The associated problem of stabilizing and isolating sludge from waste-water separators is best handled by the double pond system. The ponds are used alternately, one receiving while the other is drying and undergoing cleaning. An overflow gate for each pond permits water to flow to a convenient sewer inlet. The sludge is allowed to dry as long as possible, then removed and mixed with tank bottoms or similar waste fuel and burned. When the quantity of sludge cannot be accommodated conveniently in ponds, tanks may be used.

At Skelly's El Dorado Refinery, sludge from the oil separator is transferred to sludge pits equipped with a skimming trough. Water and oil which collect above the sludge may be drained or pumped back through the oil-water separator. Sludge in waste-water drained from water-softening processes is pumped into sludge pits with gravel beds. Water filtering through the gravel bed is collected and pumped back to the plant for re-use. Chemical analysis and field tests have proved this sludge to be a satisfactory agricultural fertilizer containing calcium phosphate and calcium carbonate which furnishes a slow-acting phosphate that leaches away very slowly.

On the other hand, acid-sludges resulting largely from refinery treatment of oils and sulfuric acid alkylation catalyst constitute a serious disposal problem to most refineries. The principal methods employed for large volume disposal of acid sludges are: 1) burning, 2) hydrolysis, and 3) high-temperature decomposition.

As burning destroys potentially useful materials, this method is employed only when other methods are uneconomical. Furthermore, the operation of sludge burners entails many difficulties including rapid corrosion plus problems of feed transport and maintenance of a homogeneous fuel phase.

Hydrolysis of acid-sludge into two layers is effected by treatment with hot water in lead-lined vessels to protect against sulfuric acid corrosion. The aqueous layer obtained contains 30-50 percent sulfuric acid which can be used for pickling liquor, fertilizer production, or reconcentration. The oily phase is satisfactory as a fuel.

Decomposition of acid sludge can be accomplished in the temperature range 250-650°C by reduction of the sulfuric acid to sulfur dioxide by the organic matter present, or by thermal decomposition of the acid at very high temperatures (1100-1200°C).

Dilute solutions of sulfur compounds, including sulfides and mercaptans, require treatment to eliminate obnoxious pollutants. Hydrogen sulfide can be removed effectively from aqueous solutions by stripping with steam or gas in a packed tower or fractionating column. Exhaust steam or gas rises through the column, stripping the sulfur compounds from the preheated waste introduced in the upper portion. The overhead steam is condensed and returned to the tower, while the non-condensible gases are burned in a furnace.

Sulfur compounds present in low concentration also can be treated chemically by oxidation to thiosulfates and elemental sulfur, or by precipitation with such salts as zinc chloride and copper sulfate.

The wide use of caustic in the refining of petroleum poses a problem in the disposal of spent-caustic solutions. The high alkalinity of caustic solutions is inimical to aquatic plants and animals. In addition, highly alkaline waters are corrosive to plant surfaces and some metals, necessitating pretreatment if they are to be used for many industrial purposes.

The most common method of disposing of waste caustic solution is dilution with river flows or large bodies of water. Volume III of the American Petroleum Institute's "Manual on Disposal of Refinery Wastes: Chemical Wastes" emphasizes that the extent to which dilution can be practised safely depends largely upon local conditions, and that careful consideration should be given to the effect of such dilution on waters which serve as a source of domestic water supply or recreational purposes.

The aforementioned Manual recommends the disposal well as a convenient and suitable method for disposal of spent-caustic when local conditions permit. This method consists of pumping the spent caustic solutions into underground strata containing non-potable or saline water.

Chemical methods, involving neutralization and oxidation, also have been developed for the disposal of waste caustic solutions. However, these procedures are more complex and expensive than direct disposal and should be tried first on a semi-plant scale.

Another chemical waste which constitutes a disposal problem is the phenolic group. These compounds arise from the treatment of cracked distillates, and also are found in the process accumulator waters from cracking operations. If allowed to escape into streams, phenols impart obnoxious tastes and odors, and also are toxic to fish and aquatic plants.

Several effective treatments have been devised for the disposal of phenolic wastes. One method utilizes the fact that phenols can be liberated from alkaline solutions, in which they are soluble, by acidification. The phenol layer is then skimmed off and used as plant fuel or sold as a chemical. Several solvent-extraction processes also are capable of removing approximately 90 percent of the phenols from waste waters.

Recent pilot-plant studies by the Ozone Process Division of the Welsbach Corporation indicate that oxidation with ozone, preceded by proper pretreatment, offers an effective and economical method for the destruction of phenols in waste waters.

Interest has been focused on the biological oxidation of phenolic wastes by the announcement that Sun Oil Company Limited's new Sarnia refinery has constructed a commercial bacterial oxidation installation for the removal of phenol or other organic waste material.

Sun's installation comprises three separate systems for the preliminary segregation and treatment of different types of waste water from the refinery. These have been hailed as a model for future refineries, and this type of installation has been adopted by the American Petroleum Institute as a standard for the industry, according to company engineers.

This initial segregation of waste-water streams is a feature necessary for the economical installation of the bacterial oxidation process. Without preliminary segregation, such a process would require a lengthy installation period and consequently greater expense.

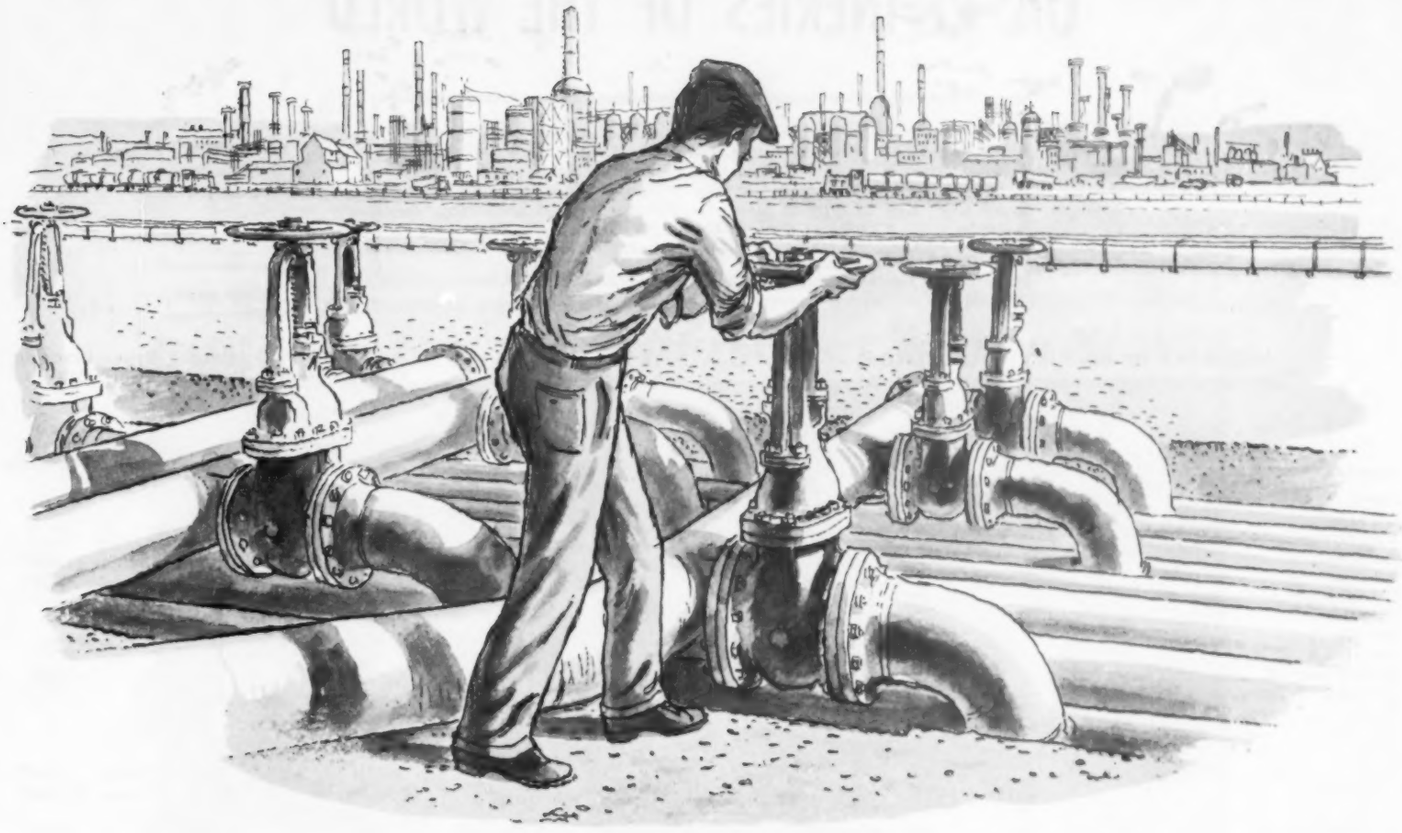
Sun's new bacterial oxidation process operates as follows: Waste water from a process separator (which removes any free oil present) is mixed with a stream of purified water. The diluted waste water is then pumped to a large oxidation pit 90 feet long, 70 feet wide, and 12 feet deep. This stream enters from the bottom of the pit through a network of 40 eductor jets which aerate the water by adding minute particles of air, and eject it in a fine spray.

These eductors perform two important functions. They keep the water circulating in the oxidation pit with an activated sludge containing millions of bacteria. Also, they add the necessary oxygen to the water to sustain the bacteria, which consume the phenol or other organic waste material in the water—transforming it by decomposition to a harmless organic material.

After circulating in the oxidation pit for from six to eight hours, the treated water is drawn off through an overflow line at the top of the ten-foot water level. It then flows to another separator which collects the bacterial sludge present for clarification of the effluent.

The bacterial sludge is drawn off and pumped back to the oxidation pit, ready

(Continued on page 168)



Speeding the flow

When the flow of oil must wait for the erection of new plant, the degree of skill and resource brought to the work of construction is a major economic factor. For this skill there is no firm grounding other than wide, first-hand, practical experience of process engineering for petroleum and petrochemicals, of the kind possessed by D. & C. and William Press Ltd.

D & C
AND WM.
PRESS
LTD.

civil, mechanical and chemical construction engineers at home and abroad

Head Office : **27, ASHLEY PLACE, LONDON, S.W.1.** Tel : VICtoria 9751 (6 lines) 'Grams : Demcopress, London

OIL REFINERIES OF THE WORLD

The tabulation below has been prepared to show the present capacities and status of oil refineries outside the United States where such information is available. No data is given on U.S.S.R. plants or refineries in nations dominated by the Russians. Capacities are barrels per day. Key to type of plant: S—Skimming; L—Lubricating; A—Asphalt; C—Cracking; Comp.—Complete. Under cracking capacity to indicate type: T—Thermal; C—Catalytic.

SUMMARY OF REFINERY CAPACITIES

Operating or Operable Capacities, July 1, 1954

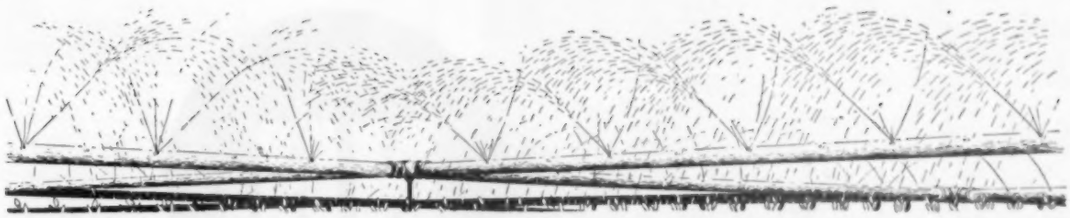
* Estimated — ** Unknown

Country	No. Plants	Crude Capacity Barrels Daily	Cracking Capacity Barrels Daily
Aden	1	120,000	.....
Albania*	1	3,000	.....
Argentina	17	193,820	61,620TC
Australia	5	59,740	.....
Austria*	7	42,863	.....
Bahrain Island	1	186,500	47,700TC
Belgium	7	69,600	16,200TC
Bolivia	4	12,340	.....
Brazil	5	11,950	2,000T
British Borneo	1	47,300	.....
Bulgaria*	1	2,300	.....
Burma	2	3,700	.....
Canada	43	529,580	267,825TC
Chile	3	360	.....
China	1	1,000	.....
Colombia	3	42,600	15,130C
Cuba	6	11,000	3,000T
Czechoslovakia*	1	8,000	**
Denmark	3	775	.....
Ecuador	2	5,450	.....
Egypt	2	153,000	6,400T
Formosa	1	18,000	5,500T
France	15	556,350	74,150TC
Germany	32	228,775	78,210TC
Hawaiian Islands	1	3,000	.....
Hungary*	3	35,000	**
India	1	10,000	1,700T
Indonesia	5	205,300	41,000T
Iran	3	622,100	130,000TC
Iraq	3	17,730	.....
Israel	1	85,000	18,000T
Italy	33	260,850	19,000TC
Japan	16	145,440	14,600TC
Kuwait	1	30,000	.....
Lebanon	1	11,000	.....
Mexico	8	228,200	22,100T
Netherlands	2	231,000	59,000TC
Netherlands West Indies	2	670,000	483,000TC
Norway	1	1,500	.....
Pakistan	1	5,500	1,500T
Peru	3	47,300	14,000T
Poland*	1	5,000	**
Portugal	1	25,000	8,000C
Romania*	**	135,000	**
Saudi Arabia	1	189,000	.....
South Africa	2	17,800	7,700TC
Spain	3	61,000	3,500T
Sweden	4	37,000	2,300T
Switzerland	2	1,850	.....
Trieste	3	23,500	.....
Trinidad	3	122,000	27,500TC
Turkey	1	220	.....
United Kingdom	17	598,300	106,200TC
U.S.S.R.*	**	1,200,000	**
United States	338	8,243,000	3,750,000TC
Uruguay	1	25,200	2,200C
Venezuela	12	471,700	126,500TC
Yugoslavia	3	13,000	1,100T
Totals	641	16,085,493	5,416,635TC
Western Hemisphere	450	10,614,500	4,774,875TC
Eastern Hemisphere	191	5,470,993	641,760TC

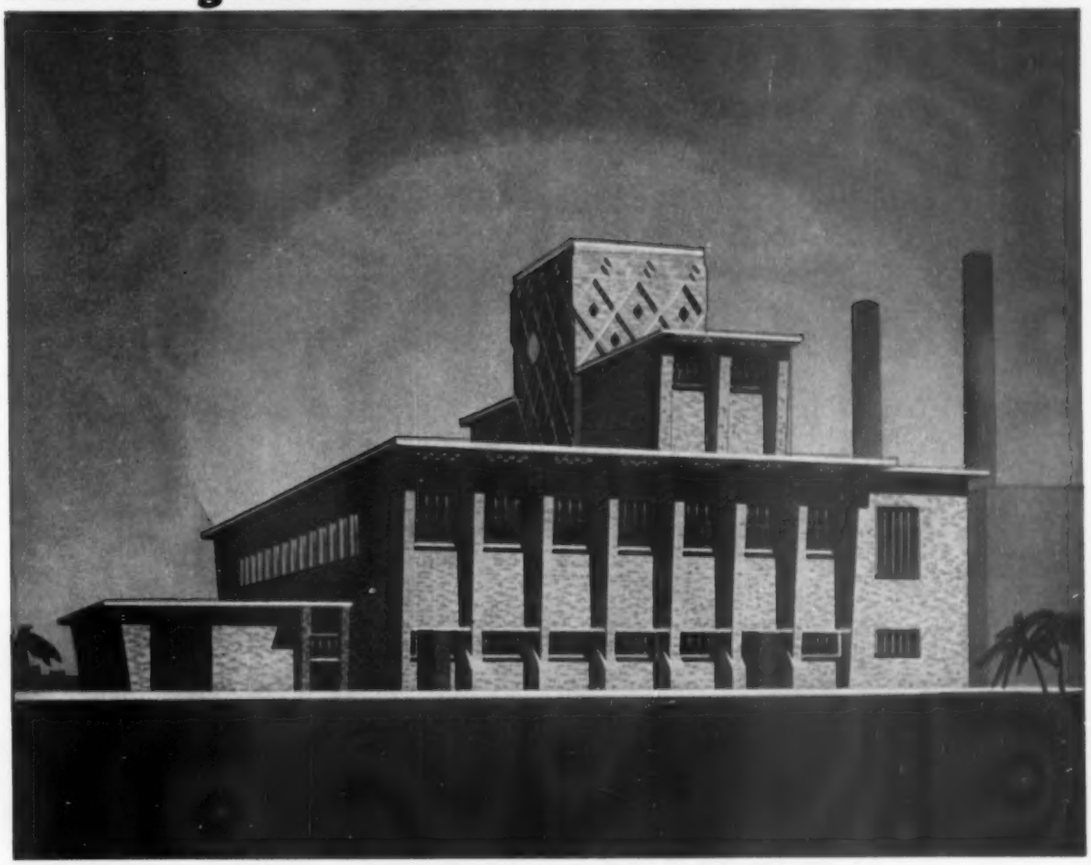
Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Albania:				
Cerzic	Tirana-Eibassan	3,000	SLA	—
Aden:				
Aden Petroleum Refinery, Inc.	Little Aden [1]	120,000	S	—
[1] Refinery due to commission Aug. 1954. 12,000 b/d Platforming unit.				
Argentina:				
Cia. General Asfaltos	Wilde (B.A.)	370	L	—
Esso Refinadora de Petroleo	Campana (B.A.)	25,000	Comp.	11,000T
	Bahia Blanca	5,500	SC	2,300T
	Manuel Eloridi	1,700	S	—
	Dadin	500	S	—
Condor	Avellaneda (B.A.)	1,000	S	—
Diadema Argentina S.A. de Petroleo	Buenos Aires	18,000	SC	9,000T
La Isaura	Bahia Blanca	1,800	SC	1,000T
Loterro y Papini	Avellaneda (B.A.)	300	SL	—
Ragor S.A.	Quilmes (B.A.)	150	SL	—
Y.P.F. (Enoe)	Dock-Sun Avellaneda (B.A.)	6,000	Comp.	600T
	Eva Peron	103,500	Comp.	25,000T
	San Lorenzo (Santa Fe)	15,800	SC	6,200T
	Lujan de Cuyo (Mendoza)	5,500	SC	3,000T
	Chachapoyas (Salta)	1,900	SC	950T
	Plaza Huincul (Neuquen)	1,300	SC	570T
	Comodora Rividavia	5,500	SC	2,000T
Australia:				
Australian Oil Refinery Ltd.	Kurnell (Nr. Sydney) [1]	24,000	SC	15,000C
Bitumen & Oil Refineries Ltd.	Sydney [2]	6,500	SA	—
Commonwealth Oil Refineries Ltd.	Laverton, Victoria	3,420	S	—
Shell Co. of Australia Ltd.	Clyde	8,400	SLA	—
Standard Vacuum Refining Co. Ltd.	Altona [3]	2,000	SLA	—
Shell Refining Pty. (Aus.)	Geelong [4]	36,000	S	—
[1] Construction of the refinery scheduled to be completed 1955.				
[2] 1,400 b/d platformer capacity.				
[3] Capacity to be increased to 25,000 b/d. Building 10,000 b/d TCC unit to be completed early 1955.				
[4] 13,000 b/d cat cracker being built. Will be completed mid 1955.				
Note: Anglo-Iranian Oil Co. to build 52,000 b/d refinery at Kwinana. National Oil Pty., Ltd. refinery closed and sold for removal.				
Austria:				
Vacuum Oil Co.	Kagran	4,200	SLA	—
A. G. de Shell-Floridsdorfer Mineraloelfabrik	Floridsdorf	3,400	SLA	—
Oesterreichische Mineraloelwerke (Soviet) [1]	Lobau	7,700	S	—
Benzin-Bensolverband (Soviet) [1]	Voesendorf	4,670	SLA	—
NOVA Mineraloel Raff. A.G. [1]	Schwechat	8,472	Comp.	—
Deutsche Gasolin (Soviet) [1]	Korneuburg	7,700	S	—
Donau Oel G.m.b.H. (Soviet) [1]	Moosbierbaum	6,720	SC	—
[1] Operated by the Soviet Mineral Oil Administration.				

Note: The Hauskirchen refinery has not been in operation since the close of World War II. It was located in the Zisterdorf area, i.e. in Lower Austria province, in the Soviet occupation zone. The Ebensee refinery was dismantled voluntarily by the Austrian state, and sold to a French Morocco refining company. Never in operation since April 1945, the sale was completed in 1950.

(Continued on page 145)



Building for the Industries of the World



WATER

Kuwait Seawater Distillation Plant to the design of the Consulting Engineers,
Ewbank & Partners, and Architects, Farmer & Dark, F/F.R.I.B.A.,

was constructed by

THE GULF ENGINEERING COMPANY (KUWAIT) LTD.

part of the organisation of

RICHARD COSTAIN LIMITED BUILDING & CIVIL ENGINEERING CONTRACTORS

DOLPHIN SQUARE, LONDON, S.W.1 VICTORIA 6624

BRANCHES: MIDDLE EAST · RHODESIA NIGERIA

excess H_2 to NH_3

by

Casale ammonia synthesis

55 Tons per day of liquid anhydrous Ammonia is being produced at this new plant of the Pennsylvania Salt Manufacturing Company at Wyandotte, Michigan. The Hydrogen is a by-product from Pennsalt's adjacent chlorine plant.

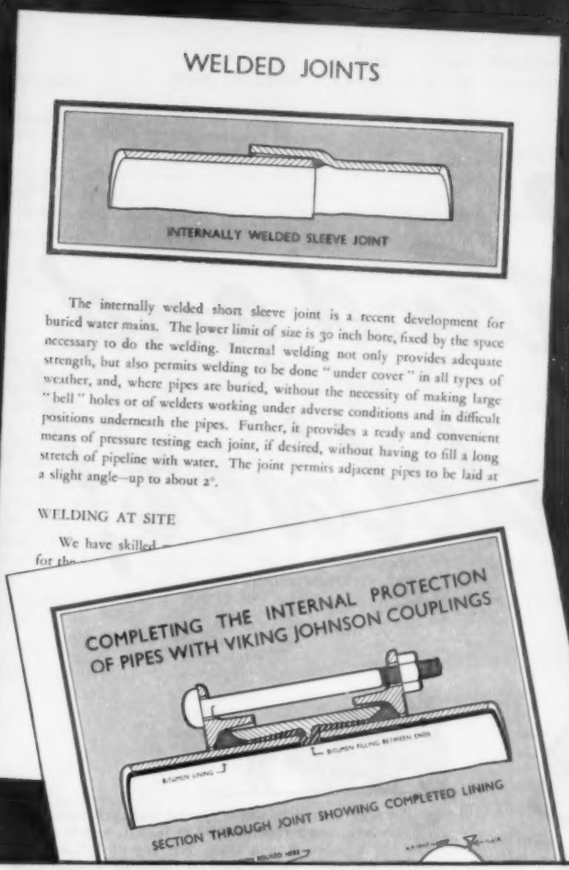
The photographs show the Liquid Air Plant and the control board in the compressor building; also, the Casale ammonia condenser, deoxidation reactor and convertor.

For a general description of this installation, designed, constructed and licensed by Foster Wheeler:

write for HE—4-54

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK


WELDED JOINTS
INTERNALLY WELDED SLEEVE JOINT
The internally welded short sleeve joint is a recent development for buried water mains. The lower limit of size is 30 inch bore, fixed by the space necessary to do the welding. Internal welding not only provides adequate strength, but also permits welding to be done "under cover" in all types of weather, and, where pipes are buried, without the necessity of making large "bell" holes or of welders working under adverse conditions and in difficult positions underneath the pipes. Further, it provides a ready and convenient means of pressure testing each joint, if desired, without having to fill a long stretch of pipeline with water. The joint permits adjacent pipes to be laid at a slight angle—up to about 2°.
WELDING AT SITE
COMPLETING THE INTERNAL PROTECTION OF PIPES WITH VIKING JOHNSON COUPLINGS
BITUMEN LINING
BITUMEN FILLING BETWEEN ENDS
SECTION THROUGH JOINT SHOWING COMPLETED LINING

S&L

NEW EDITION

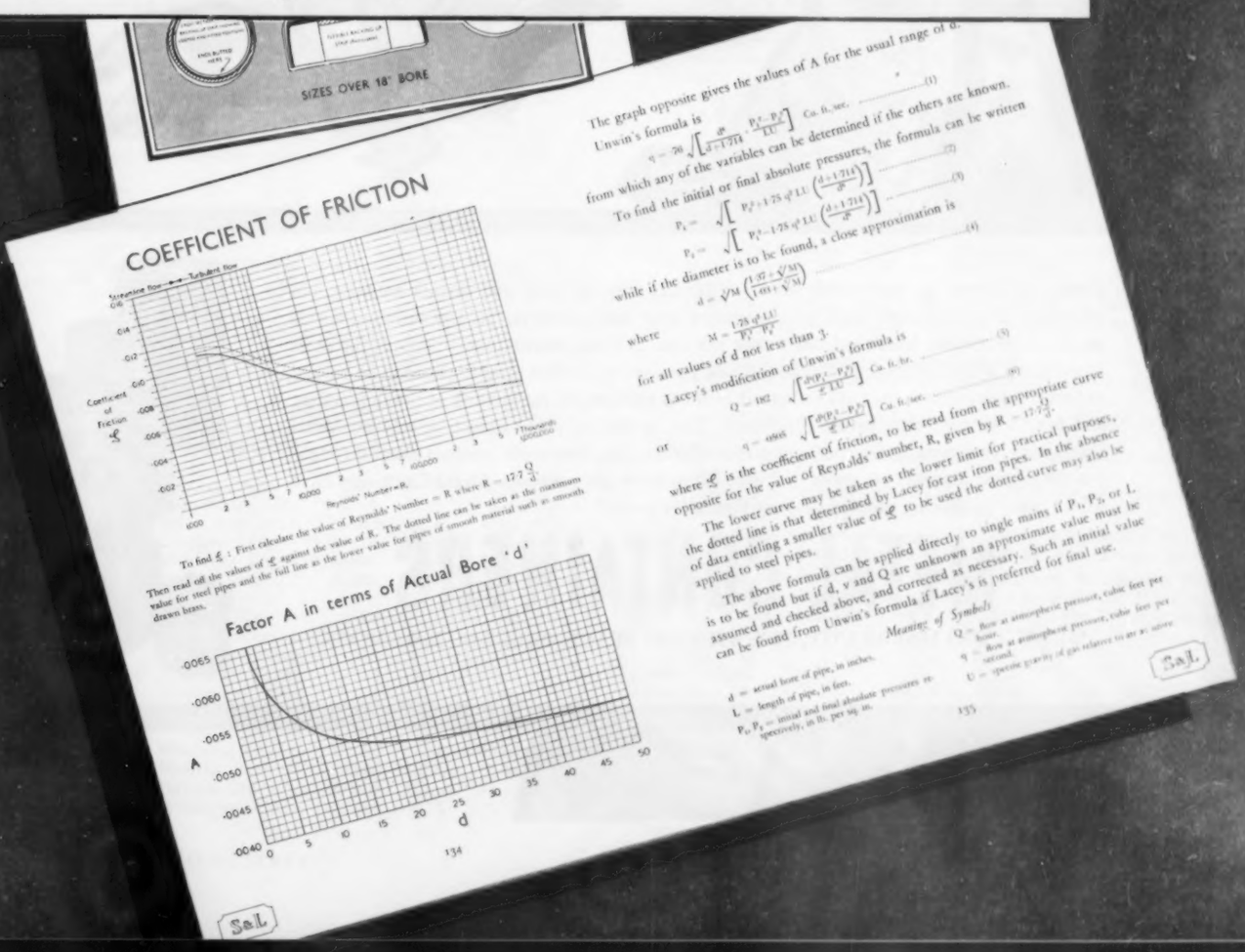
S&L SECTION 'M' CATALOGUE

This catalogue tells an engineer all he needs to know about steel mains for water, gas, sewage and air. Copies are available from 41 Oswald Street, Glasgow, C.1

STEWARTS AND LLOYDS LIMITED

GLASGOW · BIRMINGHAM · LONDON

The largest manufacturers of steel tubes in Europe


SIZES OVER 18" BORE
COEFFICIENT OF FRICTION
Streamline flow
Turbulent flow
Coefficient of Friction
Reynolds' Number = R where R = 17·7 Q/d
To find f : First calculate the value of Reynolds' Number R. The dotted line can be taken as the maximum value for steel pipes and the full line as the lower value for pipes of smooth material such as smooth drawn brass.
Factor A in terms of Actual Bore 'd'
A
d
The graph opposite gives the values of A for the usual range of d.
Unwin's formula is
from which any of the variables can be determined if the others are known.
To find the initial or final absolute pressures, the formula can be written
while if the diameter is to be found, a close approximation is
where
for all values of d not less than 3".
Lacey's modification of Unwin's formula is
or
where f is the coefficient of friction, to be read from the appropriate curve opposite for the value of Reynolds' number, R, given by R = 17·7 Q/d.
The lower curve may be taken as the lower limit for practical purposes, the dotted line is that determined by Lacey for cast iron pipes. In the absence of data entitling a smaller value of f to be used the dotted curve may also be applied to steel pipes.
The above formula can be applied directly to single mains if P1, P2, or L is to be found but if d, v and Q are unknown an approximate value must be assumed and checked above, and corrected as necessary. Such an initial value can be found from Unwin's formula if Lacey's is preferred for final use.
Meaning of Symbols
d = actual bore of pipe, in inches.
L = length of pipe, in feet.
P1, P2 = initial and final absolute pressures respectively, in lb. per sq. in.
Q = flow at atmospheric pressure, cubic feet per hour.
q = flow at atmospheric pressure, cubic feet per second.
U = specific gravity of gas relative to air as unity.
134
135
S&L

Stand and deliver!

The highwayman of the eighteenth and early nineteenth century, much romanticised in fiction, was in reality little more than a thug. His cry of "Stand and deliver!" was dreaded by timorous travellers, as the prelude to ruthless highway robbery. These bandits added yet another peril to travel by stagecoach — a form of transport which already presented hazards enough!

Today's transport has its hazards, too . . . Bandits may be fewer and farther between, but whenever valuable goods must be transported over long journeys, no precautions may be neglected to prevent losses in transit. Not the least of these precautions—perhaps the most important—is safe packaging. Valuable fluids, powders or kindred products need to be packed in foolproof containers that will withstand, without leakage, the hurly-burly of rough handling and long journeys under severe conditions. That is why so many industries rely on Metal Containers for drums. Leakproof, tamperproof drums that keep their contents intact throughout the longest journeys are made in a wide range for many purposes. Metal Containers have solved many packaging problems—may they solve yours?

METAL CONTAINERS

METAL CONTAINERS LTD., 17 WATERLOO PLACE, PALL MALL, LONDON.

M-W.109

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Bahrain Island:				
Bahrain Petroleum Co.	Bahrain, Persian Gulf [1] [2]	186,500	Comp.	37,700TC [3]

[1] 25,000 b/d vacuum unit scheduled for 1955 completion.
[2] 19,500 b/d thermal reforming capacity.
[3] 22,000 b/d catalytic cracking capacity and 15,700 thermal cracking capacity.

Belgium:				
"Albatros" S.A. Belge pour le Raffinage de Petrole	Antwerp, Kiel [1]	11,000	SC	4,000C
Belgian Shell Co. S.A.	Ghent [2]	1,900	LA	—
Compagnie Industrielle "Atlas" S.A. (Esso)	Hoboken-Antwerp	2,500	S	—
Esso Standard Ref. S.A.	Antwerp [3]	28,000	SC	11,000C
Raffinerie Belge de Petroles	Antwerp [4]	18,700	SCA	1,200T
Raffineries et Distilleries Anversoise S.A. "Radain"	Antwerp [5]	4,000	S	—
Tankage et Transport S.A.	Antwerp	3,500	S	—

[1] Catalytic poly plant under construction to be complete August '54.
[2] Operated on top crude.
[3] 3,600 b/d thermal reforming capacity. LPGas facilities being installed, completion late 1954.
[4] 3,000 b/d thermal reforming capacity. 10,000 b/d cat cracker and 3,000 b/d UOP cat poly unit under construction.
[5] 750 b/sd cat. reforming (UOP) plant under construction. To be complete in 1955.

Bolivia:				
Yacimientas Petroliferos Fiscales Bolivianos	Cechamba	5,850	S	—
	Sucre	4,630	S	—
	Camiri	1,450	S	—
	Sanandita	410	S	—
Brazil:				
Conselho Nacional do Petroleo [1]	Bahia	150	S	—
	Mataripe [2]	5,000	SC	—
Distillaria Rio Grandense de Petroleo S.A.	Rio Grande	300	S	—
Industrias Matarazzo de Energia S.A.	Sao Paulo	500	S	—
Ipiranga S.A. Cia Brazilea de Petroles	Rio Grande	6,000	SCA	2,000T

[1] Conselho is erecting a 45,000 b/d plant at Cubatao, near port of Santos, to be completed in late 1955. In March 1953 a project was approved to raise capacity to 75,000 b/d. To be completed mid-1955.
[2] A new project aims at raising capacity to 15,000 b/d and producing 30,000 b/d of lubricants.

Refinariae Exploracao de Petroleo Uniao is building 20,000 b/d plant at Capuava, Municipality of Santo Andre, Sao Paulo. Planned for completion at end of 1954.

Refinaria de Petroleo de Manguinhos is building 10,000 b/d plant at Manguinhos, Rio de Janeiro, planned for completion at end of 1954.

Companhia de Petroleo da Amazonia (I.B. Sabba) is to build a 2,500 b/d plant at Manaus, on the Amazon, planned for completion in 1955.

British Borneo:				
Sarawak Oilfields Ltd.	Lutong, Sarawak	47,300	S	—

Bulgaria:

In the absence of official information, recent estimates indicate 1 refinery in operation in Bulgaria with a daily capacity of 2,300 barrels.

Burma:				
Burmah Oil Co.	Chauk	3,000	Comp.	—
Nathsingh Oil Co., Ltd.	Yenangyaung	700	S	—
Canada:				
Anglo-Canadian Oil Ltd.	Brandon, Manitoba	3,000	SC	1,375T
Anglo-American Exp. Ltd.	Hartell, Alta [1]	2,500	SC	1,500T
Bonneyville Oil Refineries	Bonneyville, Alta. [2]	1,000	S	—
British American Oil Co. Ltd.	Calgary, Alta.	7,200	SCA	2,500T
	Edmonton, Alta. [3]	7,000	SCA	3,400TC
	Moose Jaw, Sask. [4]	15,000	SCA	6,000TC
	Clarkson, Ont. [5]	17,000	Comp.	16,100TC
	Montreal, Que. [6]	45,000	SCA	21,500TC
Canadian Oil Refineries Ltd.	Sarnia, Ont.	20,000	SC	8,300C
Consumers' Co-operative Ref.	Regina, Sask.	7,000	SC	2,500T
Excelsior Refineries Ltd.	Lloydminster, Alta.	3,000	SC	—
Hi-Way Refineries Ltd.	Moose Jaw, Sask. [7]	350	S	—
	Rosetown, Sask. [7]	350	S	—
	Saskatoon, Sask.	6,500	SCA	2,600C
Husky Oil & Ref. Ltd.	Lloydminster, Alta. [8]	10,500	SA	—
Imperial Oil Ltd.	Montreal, Que. [9]	46,000	SCA	36,800TC
	Halifax, N.S. [10]	18,000	SCA	10,000C
	Sarnia, Ont. [11]	71,500	Comp.	29,100TC
	Winnipeg, Man.	12,000	SCA	5,200C
Imperial Oil Ltd. (Cont.)	Regina, Sask. [12]	17,000	SCA	17,500TC
	Edmonton, Alta. [13]	25,000	SC	18,800TC
	Calgary, Alta.	9,200	SCA	4,600T
	Vancouver, B.C.	22,500	SCA	11,500C
	Norman Wells, NWT	1,250	S	—
McColl Frontenac Oil Co. Ltd.	Montreal East, Que. [14]	43,000	SC	20,200TC
	Edmonton, Alta. [15]	6,100	SC	4,800TC
Moose Jaw Refineries Ltd.	Moose Jaw, Sask.	1,800	SA	—
New Brunswick Oilfields Ltd.	Weldon, N.B.	300	S	—
Northern Petroleum Corp. Ltd.	Kamsack, Sask.	800	S	—
North Star Oil Ltd.	St. Boniface, Man. [16]	4,500	SC	850T
Prince Albert Refineries Ltd.	Prince Albert, Sask.	1,000	SLA	—
Petroleum Fuels Ltd.	Moose Jaw, Sask.	1,000	S	—
Riverlakes Oils Ltd.	Ft. William, Ont. [17]	4,000	SC	—
Royalite Products Ltd.	Kamloops, B.C. [18]	5,000	Comp.	—
Refinery Operators Ltd.	Coleville, Sask.	5,000	SA	—
Radio Oil Refineries Ltd.	East Kildonan, Man.	500	S	—
Shell Oil Co. of Canada Ltd.	Shellburn, B.C. [19]	15,000	SCA	5,200TC
	Montreal East, Canada [20]	42,000	SC	23,000TC
Standard Oil Co. of B. C. Ltd.	N. Burnaby, B.C.	8,350	SA	—
Sun Oil Co.	Sarnia, Ont.	15,000	SC	11,000C
Supreme Refineries, Inc.	Ogden	500	S	—
Trinidad Leaseholds (Canada) Ltd.	Port Credit, Ont. [21]	7,500	SC	3,500T
Wainwright Refineries Ltd.	Wainwright, Alta.	650	S	—

[1] Capacity to be increased to 3,500 b/d during 1954.
[2] Capacity to be increased to 2,500 b/d by Nov. 1954.
[3] 1,400 thermal cracking capacity and 2,000 b/d catalytic cracking capacity.
[4] 1,500 b/d thermal cracking capacity and 4,500 b/d catalytic cracking capacity.
[5] 4,500 b/d thermal cracking capacity and 11,600 b/d catalytic cracking capacity.
[6] 3,500 b/d thermal cracking capacity and 18,000 b/d catalytic cracking capacity.
[7] Closed down since January 1949.
[8] 1,000 b/d diesel desulfurization unit under construction. To be complete Sept. 1954.
[9] 10,500 b/d thermal cracking capacity and 16,300 b/d catalytic cracking capacity. 41,400 b/d atmospheric and vacuum unit and 1,500 b/d fluid cat cracker under construction. To be complete Nov. 1954.
[10] Atmospheric and vacuum unit and fluid cat cracker under construction. To be complete mid-1955.
[11] 4,000 b/d thermal cracking capacity and 24,100 catalytic cracking capacity, 8,000 b/d reforming capacity.
[12] 10,000 b/d thermal cracking capacity and 7,500 b/d catalytic cracking capacity.
[13] 9,100 b/d thermal cracking capacity and 9,600 b/d catalytic cracking capacity. Lube oil manufacturing facilities, solvents, dewaxing, phenol and clay plant under construction. To be complete Spring 1955.
[14] 4,200 b/d thermal cracking capacity and 16,000 b/d catalytic cracking capacity, 4,500 b/d reforming capacity.
[15] 2,200 thermal cracking capacity and 2,600 b/d catalytic cracking capacity. Capacity to be increased to 11,000 b/d and a 3,000 b/d thermal cracking unit to be installed. To be complete July 1955.
[16] Contract signed for 8,000 b/d refinery, cat cracker and polymerization unit. Complete July 1955.
[17] 1,200 b/d catalytic reforming capacity.
[18] 1,450 b/d cat cracker under construction. To be complete end of 1954.
[19] 3,800 b/d thermal cracking capacity and 1,400 b/d catalytic cracking capacity.
[20] 8,000 b/d thermal cracking capacity and 15,000 b/d catalytic cracking capacity.
[21] 700 b/d reforming capacity. 1,500 b/d Platformer under construction. To be complete Aug. 1954.

Note: Canadian Petrofina Ltd. is building a 20,000 b/d refinery with 10,000 b/d cat cracker at Montreal which is to be on stream by mid-1955.

Standard Oil Co. of British Columbia, Ltd. building a 11,000 b/d refinery on the south shore of Burrard Inlet in Burnaby. Plant to include 3,700 b/d cat. cracker and a 800 b/d polymer unit. To be complete late 1954.

Chile:				
Johannsen, G. H.	Coquimbo, Chile	125	S	—
Maritano, Miguel	Talcahuano	60	S	—
Soc. Establecimientes Quimicos	Vina del Mar	175	S	—

Note: Empresa Nacional del Petroleo is building a 20,000 b/d refinery with thermal cracking 5,060 b/d, and reforming facilities of 4,160 b/d, completion late 1954.

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
China:				
Chinese Government	Kensu	1,000	S	—
Colombia:				
Colombian Petroleum Co.	Tibu	2,200	S	—
International Petroleum (Colombia) Ltd.	Barrancabermeja, (1)	39,400	Comp.	15,130C
The Texas Petroleum Co.	Guamo	1,000	S	—

(1) Expansion of plant to be completed August 1954. 16,500 b/sd visbreaking unit included.

Note: International Petroleum Co. planning a 25,000 b/d refinery at Cartagena. This refinery planned to go on stream by 1958.

Cuba:				
Cia. Exploradora de Petroleo	Jarahueca	400	S	—
Cia. Petrolera Jarahueca	Jarahueca	600	S	—
Cuban Oil Ref. Co.	Cabaiguan	1,000	SC	500T
Destiladora Jarahueca	Santa Clara	200	S	—
Esso Standard Oil Co.	Belot	8,500	SCA	2,500T
Union Gas Co.	Bacaranao	300	S	—

Czechoslovakia:

In the absence of official information, recent estimates indicate a total of 1 refinery in Czechoslovakia with a daily crude capacity of 8,000 barrels.

Denmark:				
AA/S Kalundborg Oileraffinaderi	Kalundborg	650	A	—
Dansk Mineraloliefabrik	Copenhagen	60	SL	—
L. C. Glad & Co.	Copenhagen	65	SL	—
Ecuador:				
Anglo Ecuadorian Oilfields Ltd.	La Libertad	4,800	S	—
Manabi Exploration Co.	Cautivo	650	SL	—
Egypt:				
Anglo-Egyptian Oil Fields Ltd.	Suez	44,000	SCA	6,400T
Raffinerie de Petrole du Government	Suez	9,000	SA	—
Formosa:				
Chinese Petroleum Corp.	Kaoshiung, Taiwan (1)	18,000	SCL	5,500T

(1) Projected enlargement of refinery to include a 10,000 b/d feed preparation and gas recovery system and a 6,500 b/d thermofor cat cracker.

France:				
Compagnie Francaise de Raffinage	La Mede (1)	68,000	SCA	14,000TC
	Gonfreville (2)	75,000	Comp.	9,000T
Compagnie de Raffinage Shell-Berre	Petit-Couronne (3)	50,000	Comp.	5,000T
	Pauillac	12,000	SA	—
	Berre (4)	70,000	Comp.	8,000C
Pechelbronn SAEM	Merkwiller	1,600	Comp.	200T
Raffineries Francaises de Petrole de L'Atlantique	Donges (5)	32,000	SC	11,800C
Raff. de Petrole de la Gironde	Bec d'Ambes (6)	16,500	S	—
Ste. Cherifienne des Petroles	Petitjean (Morroco)	4,000	SC	2,650C
Ste. Generale des Huiles de Petrole	L'Avera (7)	47,000	S	—
	Dunkerque (8)	46,000	Comp.	—
Socony-Vacuum Francaise	N. Dame de Gravenchon (9)	18,000	Comp.	—
	Frontignan (10)	24,000	SC	13,500C
Standard Francaise des Petroles	Port Jerome (11)	81,650	Comp.	10,000C
	La Mailleraye (12)	600	S	—

(1) 2,000 b/d thermal cracking capacity, 12,000 b/d catalytic cracking capacity, and 11,000 b/d reforming (thermal) capacity. 67,000 b/d topping plant to be complete end of 1955.
(2) 13,000 b/d thermal reforming end of 1955.
(3) 3,500 b/d thermal reforming capacity.
(4) 9,000 b/d thermal reforming capacity.
(5) 4,400 b/d thermal reforming capacity.
(6) 3,600 b/d thermal reforming capacity.
(7) 4,600 b/d thermal reforming capacity. Tests have been made on 6,000 b/d catalytic reformer.
(8) 7,000 b/d thermal reforming capacity.
(9) 2,250 b/d thermal reforming capacity.
(10) 2,250 b/d thermal reforming capacity.
(11) 9,720 b/d thermal reforming capacity.
(12) Medicinal & technical white oil greases and special products.

Hungary:

In the absence of official information, recent estimates indicate a total of 3 refineries in Hungary with a daily capacity of 35,000 barrels.

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Germany:				
Badische Anilin & Soda-Fabrik	Ludwigshafen-on-Rhine	1,000	SL	—
BP Benzin-und Petroleum-GmbH (Anglo-Iranian)	Hamburg-Finkenwerker (1)	27,000	SC	4,900T
Coelner Benzin-Raffinerie	Cologne (2)	320	(2)	
Deutsche Erdoel-A.G.	Heide	12,000	SCAL	7,650C
	Wietze	1,100	SLA	—
	Hamburg-Grasbrook	1,600	SL	—
Deutsche Gasolin A.G.	Dollbergen-Lehrte (2)	2,465	Comp.	—
Deutsche Shell A.G.	Hamburg-Harburg	10,000	SLA	—
	Monheim on Rhine	4,000	SLA	—
	Hamburg-Grasbrook (2)	1,700	L	—
	Duesseldorf-Reisholz (2)	900	(2)	—
	Hamburg-Wilhelmsburg (2)	850	(2)	—
Deutsche Vacuum Oel A.G.	Bremen-Oslebshausen	15,000	Comp.	10,000C
	Wedel on Elbe	900	SL	—
Esso A.G.	Hamburg-Harburg (3)	36,700	SCLA	8,700C
Gelsenberg Benzine A.G.	Gelsenkirchen (4)	36,000	SH	10,000C 9,200 (12)
Gewerkschaft Deurag-Nerag	Misburg n. Hannover (5)	12,000	Comp.	4,500T
George Greiser/Pfeiffer	Dollbergen	500	SL	—
Johann Haltermann	Hamburg-Wilhelmsburg (2)	2,100	(2)	—
Kraftstoff-Handelsgesellschaft mbH.	Essen (7)	750	S	—
Mineraloel-und Asphaltwerke A.G. (MAWAG)	Ostermoor on Kiel Canal	2,100	SA	—
Mineraloelwerke Albert Senge-wald	Dedenhausen (Hannover (7)	900	SL	—
Mineraloelwerke Peine (Schindler)	Peine (Hannover)	320	SL	—
Mineraloelwerke Albrecht & Co.	Hamburg-Grasbrook (2)	250	L	—
Oelwerke Julius Schindler GmbH.	Hamburg-Neuhof	5,000	Comp.	—
Ruhrbau GmbH.	Muelheim on Ruhr	4,300	S	—
Ruhrchemie, A.G.	Oberhausen-Holten (8)	6,150	Comp.	3,260T
Ruhroel GmbH.	Bottrop (9)	2,700	S	—
Scholven-Chemie A.G.	Gelsenkirchen-Buer (10)	10,000	SCH	5,000C (12)
Union Rheinische Braunkohlen Kraftstoff A.G.	Wesseling n. Cologne (11)		SCH	9,000T 6,000 (12)
Wintershall A.G.	Salzbergen (Emsland)	2,000	L	—
Zeller & Gmelin	Eislingen (Wuerttemberg) (7)	170	SL	—

(1) 4,000 b/d thermal reforming capacity. 5,400 b/d Platformer under consideration.
(2) Half finished products charging capacity.
(3) Type of plant gasoline rerunning.
(4) Reforming plant under construction to be complete Oct. 1954.
(5) 3,700 b/d thermal reforming capacity.
(6) 2,500 b/d thermal reforming capacity. Lube oil plant under construction.
(7) Temporarily shut down.
(8) 4,320 thermal reforming capacity. Cat. cracker under construction.
(9) 2,500 b/d thermal reforming capacity. Reconstruction of the hydrogenation unit and construction of a cat cracker (5,500 b/d), now in process.
(10) Reconditioning of destroyed plant.
(11) 3,400 b/d thermal reforming capacity.
(12) Intake capacity for hydrogenation, H-hydrogenation.

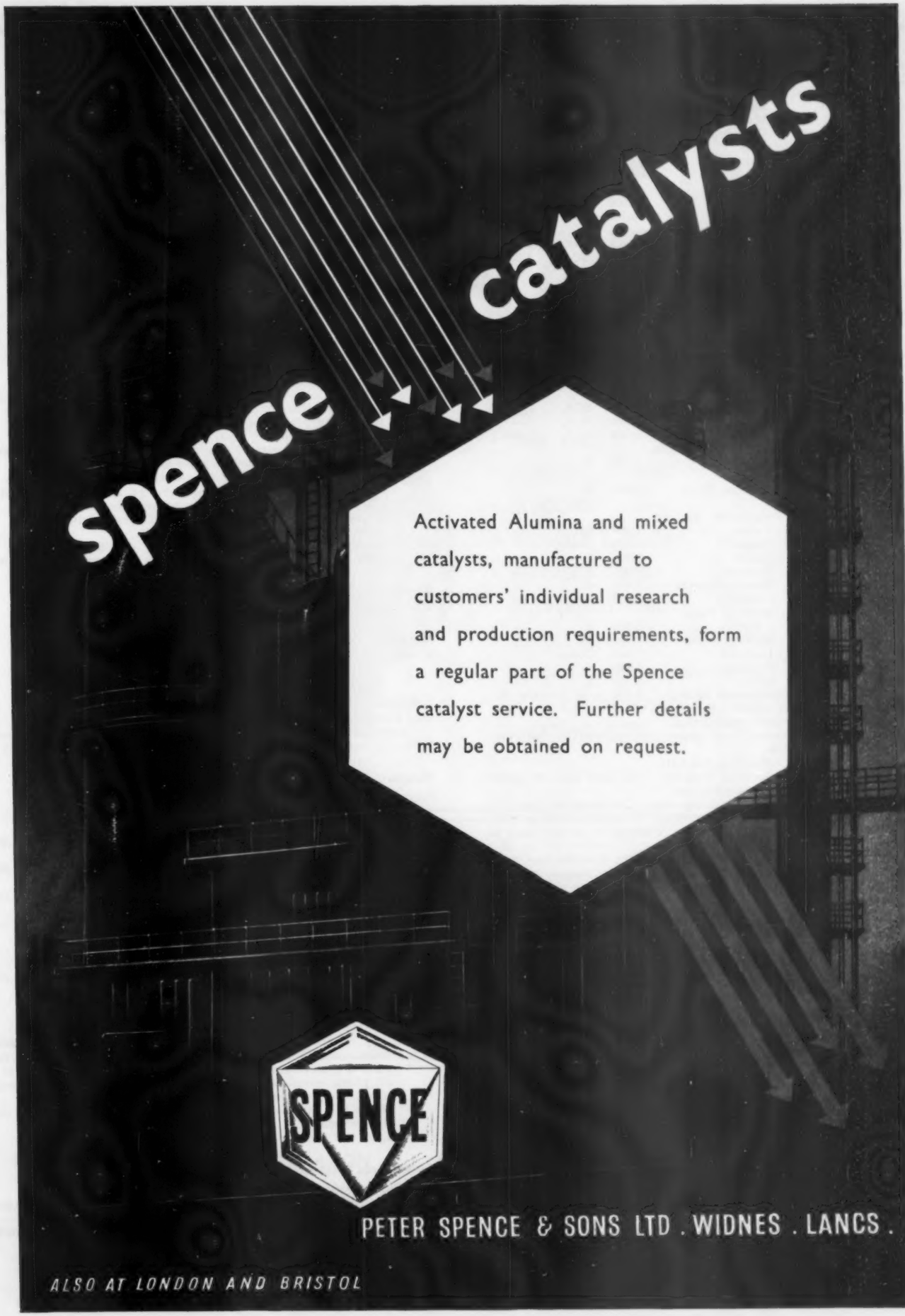
Hawaiian Islands:				
Pacific Refiners, Ltd.	Honolulu, Oahu (1)	3,000	SA	—

(1) Operates on reduced crude and butane.

India:				
Assam Oil Co.	Digboi (1)	10,000	Comp.	1,700T

(1) Lube oil plant under construction.

Note: Shell, Caltex and Standard Vacuum interests are erecting large refineries. Shell plant at Bombay is to have capacity of 40,000 b/d, to be complete mid-1955; Standard plant capacity will be 25,000 b/d, to be completed in August; Caltex plant at Vishakapatnam to have a capacity of 10,000 b/d.


spence catalysts
Activated Alumina and mixed catalysts, manufactured to customers' individual research and production requirements, form a regular part of the Spence catalyst service. Further details may be obtained on request.
SPENCE
PETER SPENCE & SONS LTD . WIDNES . LANCS .
ALSO AT LONDON AND BRISTOL

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Italy:				
Anonima Petroli Italiani (API)	Falconara [1]	14,000	S	—
Asfalti Bitumi-Catrami e Derivati (ABCD)	Ragusa, Sicily	100	A	—
Aurora	Marghera, Venice	400	S	—
Bianchi Petroli	Cologno Monzese	1,000	S	—
CONDOR	Rho	45,000	SC	15,000C
Delle Piane	Genoa	1,000	S	—
Distilleria Italian Cantrami Affini (DICA)	Carrara	3,000	S	—
Galletti	Florence	3,500	S	—
Garrone	Genoa	5,700	S	—
Industria Raffinazione Oli Minerali (IROM)	Marghera, Venice [10]	30,000	SC	1,000T
I.C.I.P.	Mantova [2]	10,000	S	—
Idrocarburi Nazionali (SIN)	Pietramala, Florence	250	S	—
I.P.L.O.M.	Genoa	1,000	S	—
I.L.S.E.A.	Valmadrera, Como [3]	2,700	S	—
I.N.P.E.T.	La Spezia [4]	32,000	SA	—
Industria Nazionale Oli Lubrificanti (NILO)	Milan	4,500	S	—
Lombarda Petroli	Villasanta, Milan	5,500	S	—
Permolio	Genoa	15,000	SCA	1,500C
	Milan	5,000	SLA	—
	Rome	5,000	SCA	1,500C
Petroli d'Italia	Fiorenzuola d'Arda, Parma	4,500	S	—
Raffineria Siciliana Oli Minerali (RASIOM)	Aggusta, Sicily	35,000	S	—
Raffineria Oli Lubrificanti (ROL)	Viguzzolo, Alessandria	1,400	SL	—
Socony-Vacuum	Naples [5]	60,000	Comp.	—
Sanquirico	Genoa	1,400	S	—
S.A.R.O.M.	Ravenna	12,000	S	—
S.A.R.P.O.M.	Trecate, Novara [6]	13,300	S	—
Italia	Cremona	1,500	S	—
S.P.I.	Fornovo Taro, Parma	1,500	S	—
STANIC	Bari [7]	21,000	SA	—
	Leghorn [8]	17,500	Comp.	—
S.T.O.K.	Florence [9]	5,000	S	—
Volpato	Milan	2,100	S	—

[1] 1,200 b/d thermal reforming capacity. 3,500 b/sd vacuum distillation unit under construction.
[2] Visbreaking unit under construction.
[3] 600 b/d cat. reforming unit under construction, to be complete Sept.-Oct. 1954.
[4] 3,000 b/d thermal reforming capacity.
[5] 6,000 b/d thermal reforming capacity. TCC unit and cat. polymerization units under construction.
[6] 3,150 b/d thermal reforming capacity. Cat. cracker, vacuum unit and poly plant under construction, to be completed in 1955.
[7] 2,500 b/d thermal reforming capacity. Capacity to be increased to 5,000 b/sd beginning 1955.
[8] 2,000 b/d thermal reforming capacity. Fluid Hydroformer unit, capacity 8,900 b/sd under construction, to be complete in 1955.
[9] 350 b/d thermal reforming capacity. Capacity to be increased to 100,000 b/d.
[10] 7,600 b/d thermal reforming capacity.

Indonesia:				
N.V. de Bataafsche Petroleum Mij. (Shell)	Balik Papan, N.E. Borneo	48,300	SW	—
	P. Brandan, Sumatra [1]	—	—	—
	Paladju, Sumatra [2]	85,200	SC	10,000T
	Tjepu, Java	4,600	S	—
	Wonokroma, Java	3,200	SA	—
N.V. Standard Vacuum Petroleum Mij.	Sungei, Gerong	64,000	SCW	31,000T

[1] Impossible to resume operations, former capacity 23,000 b/d.
[2] 6,500 b/d thermal reforming capacity.

Iran:				
Anglo-Iranian Oil Co. [1]	Abadan	550,000	Comp.	130,000CT
	Kerminshah	2,100	S	—
	MIS [2]	70,000	T	—

[1] Refineries now under control of Persian government.
[2] Crude topping plant for Abadan refinery; makes no finished products, ships tops or bottoms to Abadan by pipe line as required for finishing.

Israel:				
Consolidated Refineries Ltd.	Haifa, Israel [1]	85,000	SCA	18,000T

[1] Thermal reforming capacity 17,000 b/d.

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Iraq:				
Iraq Petroleum Co.	Bab Gurgur	2,900	S	—
Kanaquin Oil Co. Ltd.	Alwand [1]	11,400	S	—
	Basrah [1]	3,430	S	—

[1] Refineries property of the Iraq Government operated by Kanaquin Oil Co. Ltd.

Note: Construction has begun at Beiji of a 25,000 b/d refinery for Iraq Government.

Japan:				
Daikyo Oil Co.	Yokkaichi [1]	14,000	Comp.	—
Koa Oil Co.	Marifu [2]	12,000	Comp.	1,400T
Maruzen Oil Co.	Shimotsu [3]	11,500	Comp.	—
	Matsuyama	8,000	S	—
Mitsubishi Oil Co.	Kawasaki [4]	11,240	Comp.	7,400T
Nippon Mining Co.	Funakawa	5,000	Comp.	—
Nippon Oil Co.	Akita	5,500	SLAC	1,000T
	Kashiwasaki	1,500	SLA	—
	Niigata	3,000	SLA	—
Nippon Pet. Ref. Co. Ltd.	Yokohama [5]	12,000	SLA	—
	Kuadamatsu [6]	7,000	SLA	—
Showa Oil Co.	Kawasaki	11,900	Comp.	1,300C
	Hirazaua	3,000	Comp.	—
	Niigata	5,800	Comp.	—
Toa Nenryo Kogyo Co.	Shimizu	6,000	SLA	—
	Wakayama [7]	18,000	SLW	3,500T

[1] 3,500 b/sd Houdriflow cat cracker and 218 b/sd Calif. cat. polymerization plant under construction.
[2] 1,200 b/d Platformer unit.
[3] 3,000 b/d fluid cat cracker to be complete Nov. 54. 15,000 b/d topping plant and 5,000 vacuum plant to be complete Sept. 54.
[4] MEK dewaxing, W/Wax fractionation furfural extraction. Platforming, topping, contact clay treating units. Planned catalytic cracker. 1,500 b/sd cat reforming capacity.
[5] Expansion program scheduled for 1955 completion.
[6] 1,200 b/d catalytic reforming capacity.
[7] Under construction 18,900 b/d pipe still to be complete early 1955. 4.240 b/d fluid Hydroformer to be complete early 1955.

Korea:
Plant destroyed.

Kuwait:				
Kuwait Oil Co. Ltd.	Mina al Ahmadi, Persian Gulf	30,000	SA	—

Lebanon:				
Iraq Petroleum Co. Ltd.	Tripoli	11,000	S	—

Caltex building refinery at Sidon, Lebanon with a crude capacity of 6,250 b/d and a 5,600 b/d platformer. To be on stream in mid-1955.

Mexico:				
Petroleos Mexicanos	Arbol Grande, Tampico	22,000	SLA	—
	Atzacapotzalco, D. F.	49,000	SC	12,300T
	Ciudad Madero, Tampico	72,500	SCA	1,000T
	Mata Redonda, Vera Cruz	16,000	SC	5,000T
	Minatitlan, Vera Cruz	30,000	SL	—
	Poza Rica, Vera Cruz	4,200	S	—
	Reynosa, Tampico	6,500	S	—
	Salamanca, Gto.	28,000	SC	3,800T

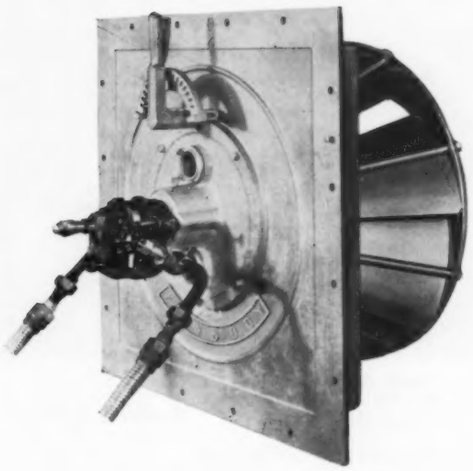
Netherlands:				
N.V. de Bataafsche Petroleum Mij. (Shell)	Pernis [1]	200,000	Comp.	53,000TC [2]
Caltex Petroleum Mij. N.V.	Pernis [3]	31,000	Comp.	6,400T

[1] 9,200 b/d thermal reforming capacity. 1,750 b/d extension of lube oil plant, complete early 1955. 3,000 tons per annum insecticide plant, complete 10/54.
[2] 20,000 b/d thermal cracking capacity, 33,000 b/d catalytic cracking capacity.
[3] 6,500 b/d thermal reforming capacity.

Netherlands West Indies:				
N.V. Curacaosche Petroleum Industrie Mij.	Curacao	200,000	Comp.	100,000T
	Aruba [2]	30,000	S	—
Lago Oil & Transport Co.	Aruba [3]	440,000	Comp.	383,000TC [4]

[1] 18,000 b/d thermal reforming capacity.
[2] Closed down.
[3] 16,000 b/d thermal cracking capacity.
[4] 340,000 b/d thermal cracking capacity, 43,000 b/d catalytic cracking capacity.

PEABODY BURNERS



for

- FUEL OILS
- BUNKER "C" FUEL
- SLUDGES
- ASPHALT & PITCH
- REFINERY GASES
- PULVERISED FUELS
- DIRECT FIRED AIR HEATERS

- FUEL OIL PUMPING & HEATING SETS

Peabody Combustion Equipment was chosen for all the modern refineries below:

A.I.O.C.: Aden, Antwerp, Grangemouth, Isle of Grain, Kwinana, Llandarcy

Caltex: Kurnell, Pernis

Esso Standard: Antwerp, Fawley

Vacuum Oil: Coryton

Lobitos Oilfields: Stanlow

Manchester Oil: Manchester

Shell: Ardrossan, Bombay, Cardon, Geelong, Pernis, Shellhaven, Stanlow

The burners supplied for the above sites form part of the thirty thousand Peabody burners already successfully installed

PEABODY ENGINEERING CORPORATION
580 FIFTH AVENUE, NEW YORK 36, U.S.A.
Telephone: Plaza 7 5100. Cable Address: Pebengcor.

PEABODY LIMITED,
PEABODY HOUSE, 300 VAUXHALL BRIDGE ROAD, LONDON S.W.1.
Telephone: Victoria 7431. Telegrams: Peabodilim, Sowest London
Cables: Peabodilim, London

Agents in the following Countries:

BELGIUM, FINLAND, FRANCE, HOLLAND, INDIA, ITALY, NORWAY, PAKISTAN, SWEDEN, S. AFRICA AND IN PRINCIPAL CITIES OF U.S.A.

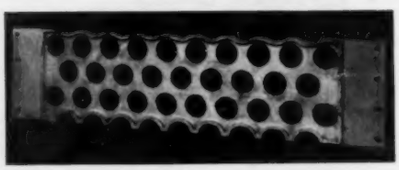
"TROPIC"

HEAT RESISTING

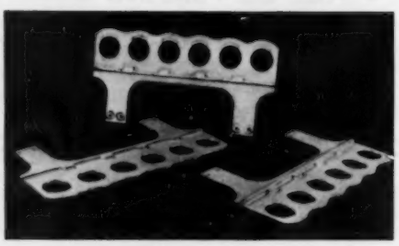
Tube Supports

MADE FROM OSBORN "TROPIC" HEAT-RESISTING STEEL

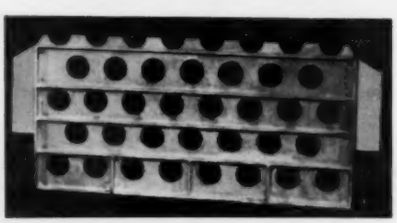
"TROPIC" Fireproof Steels have been developed primarily to provide an alloy with exceptional Heat-Resisting qualities eminently suitable for furnace parts.



"TROPIC" Tube Supports are cast from these Chrome Nickel Alloys, to meet A.S.T.M., B.S. and Oil Company Specifications.
They are guaranteed accurate to drawing dimensions and are imparted with a superfine finish. Long Service at High Temperatures is assured.



"TROPIC" Steels are available in Sheet, Plate and Bar Form, also Forgings for making up into ancillary equipment.
Samuel Osborn & Co., Limited are major producers of Heat-Resisting Steel Furnace Castings, for refineries throughout the world.



OSBORN

SAMUEL OSBORN & CO., LIMITED
SHEFFIELD • ENGLAND

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Norway:				
A. S. Norske Esso (A/S Ostlandske Petroleum-Compagni)	Valloy per Tonsberg	1,500	Comp.	—
Pakistan:				
Attock Oil Co.	Punjab, Rawahlpindi	5,500	Comp.	1,500T
Peru:				
Cia. de Petroleo Ganzo Azul	Agua Caliente	1,200	S	—
Empresa Petrolera Fiscal	Iquites [1]	1,500	S	—
International Petroleum Co.	Talara	45,000	Comp.	14,000T

[1] Refinery transferred from Zorritas.

Philippine Islands:
Caltex building a refinery at Batangas with a crude capacity of 13,000 b/d and a catalytic cracking capacity of 5,400 b/d to be completed Dec. 1954.

Poland:
In the absence of official information, recent estimates indicate 1 refinery in Poland with a daily capacity of 5,000 barrels.

Portugal:				
"Sacor" S.A. Concessionaria de Refinacao de Petroles em Portugal	Cabo Ruivo	25,000	SC	8,000C

Puerto Rico:
Caribbean Refining Co. constructing a 10,000 b/d refinery at Bayamon. UOP fluid cat cracker, cat poly unit and gas recovery unit to be included.

Romania:
In the absence of official information, recent estimates indicate that Romania has daily refinery capacity of 135,000 barrels. The number of refineries in Romania is unknown.

Saudi Arabia:				
Arabian American Oil Co.	Ras Tanura [1]	189,000	S	—

[1] 24,000 b/d thermal reforming capacity. Fluid Hydroformer with a 12,500 b/d capacity is under construction. Will be complete late 1955.

South Africa:				
So. Africa: Torbanite Mining & Refining Co.	Boksburg N. Transval	2,000	SAC	2,000T
Standard Vacuum Refining Co. of So. Africa Pty. Ltd.	Durban [1]	15,600	SAC	5,700C

[1] 2,000 b/d thermal reforming capacity.

Spain:				
"Campsa" Cia Arrandetaria del Monopolio de Petroleo S.A.	Barcelona	6,000	SL	—
"Cepsa" Cia Espanola de Petroleo S.A.	Canary Islands [1]	25,000	Comp.	3,500T
Refineria de Petroles de Escombreras, S.A.	Escombreras [2]	30,000	S	—

[1] 5,000 b/sd UOP Platforming unit, 500 b/sd UOP Udex unit under construction, to be complete late 1954.
[2] 615 b/sd furfural unit, 810 b/sd dewaxing unit, 7,000 b/sd propane deasphalting unit, 600 b/d acid treating and clay contacting unit and Lake oil plant under construction, to be complete late 1955.

Sweden:				
A-B Nymas Petroleum	Nynashamm	12,000	Comp.	2,300T
	Malmo	1,000	SA	—
Koppartrans Oljeaktiebolag	Goteborg [1]	22,000	S	—
Svenska Skifferoje A/B	Narkes-Kvarntorp [2]	2,000	S	—

[1] 4,400 b/d thermal reforming capacity.
[2] Shale oil plant.

Switzerland:				
Ipsa A.G.	Rotkreuz [1]	1,500	S	—
Schweiz-Sprengstoffabrick	Dottikon [2]	350	—	—

[1] Operates on tops.
[2] Manufactures special naphthas.

Trinidad:				
Brighton Terminal Ltd.	Brighton	5,000	S	—
Trinidad Leaseholds Ltd.	Point-a-Pierre [1]	85,000	Comp.	27,500TC [2]
United British Oilfields of Trinidad Ltd.	Point Fortin	32,000	SA	—

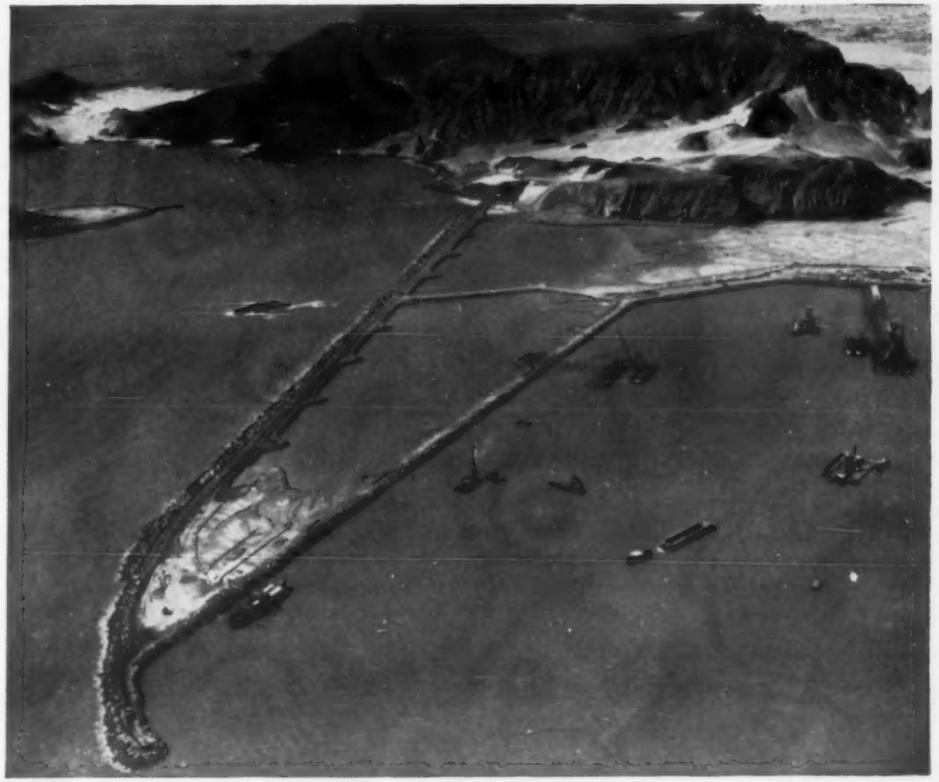
[1] 10,000 b/d thermal reforming capacity.
[2] 12,500 b/d thermal cracking capacity, 15,000 b/d catalytic cracking capacity.

THE BIRTH OF A REFINERY HARBOUR . . . . .

. . . alongside a remote barren shore in Southern Arabia. Here at Little Aden the Anglo-Iranian Oil Co., Ltd. are constructing a new Oil Refinery and Tanker Harbour and the undermentioned Joint Contractors for the dredging and reclamation are proud to be associated in the gigantic project.

Approximately 6,000,000 cubic yards of material are being dredged to form a new shipping channel, swinging ground and harbour basin, and all the dredged material is being pumped within enclosure embankments forming 200 acres of reclaimed land on which the Refinery is being constructed.

Consulting Engineers: Messrs. Rendel, Palmer & Tritton.



JOINT DREDGING & RECLAMATION CONTRACTORS

K. L. KALIS SONS & CO. LTD.

STONE HOUSE, BISHOPSGATE

LONDON, E. C. 2

TELEPHONE: BISHOPSGATE 7265 (3 LINES)
TELEGRAMS: "SOUNDINGS, PHONE LONDON"

THE DREDGING & CONSTRUCTION CO. LTD.

9, NEW CONDUIT STREET

KING'S LYNN NORFOLK

TELEPHONE: KING'S LYNN 3434 (2 LINES)
TELEGRAMS: "DEDECO KING'S LYNN"

IS PIPE SUSPENSION YOUR PROBLEM?

If so, these catalogues on

PRE-ENGINEERED PIPE HANGING

will be of great assistance

Where vertical movement needs to be controlled, Vokes Genspring Variable Support Hangers give completely satisfactory results. Where uniform support is called for, throughout the travel-range of the pipe, Vokes Genspring Constant Support Hangers keep all the resulting stresses well within safe limits. These two catalogues, giving full details of each method, will enable you to select the type of suspension appropriate to your own requirements.

VOKES GENSPRING

SUSPENSION SYSTEMS

★

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Trieste:				
Aquila S.A. Tecnico Industriale	Trieste	18,000	SCL	—
Esso Standard	Trieste	5,000	SLA	—
I.R.C.O.	Trieste	500	S	—
Turkey:				
Maden Tetkik ve Arama Enstituso	Batman [1]	200	SA	—
United Kingdom:				
Anglo-Iranian Oil Co. Ltd.	Isle of Grain, Kent [1]	80,000	Comp.	10,000C
Berry Wiggins & Co. Ltd.	Kingsmouth on the Medway nr. Rochester, Kent [2]	4,200	SLA	—
	Salford [3]	1,500	SLA	—
Briggs & Co. Ltd., Wm.	Dundee, Scotland	1,000	SLA	—
Carless Capel & Leonard	London	200	S	—
Esso Petroleum Co. Ltd.	Fawley [4]	140,000	Comp.	36,000C
Lobitos Oil Fields Ltd.	Ellesmere Port	4,000	Comp.	1,000T
London & Thameshaven Oil Wharves Ltd.	Thameshaven	2,000	LA	—
Manchester Oil Refinery Ltd.	Trafford Park	3,000	Comp.	—
National Oil Refineries Ltd.	Llandarcy, S. Wales [5]	80,000	Comp.	10,000C
Scottish Oils Ltd.	Grangemouth [6]	55,000	SC	10,000C
	Pumpherston, Scot.	9,000	SC	1,200T
Shell Refining & Marketing Co. Ltd.	Ardrossan, Scot.	2,500	A	—
	Shell Haven, Essex [7]	66,600	Comp.	—
	Stanlow, Ellesmere Port [8]	91,000	Comp.	28,000C
	Heysham, Lancs. [9]	36,000	S	—
Vacuum Oil Co. Ltd.	Coryton, Essex	17,500	Comp.	10,000C
Uruguay:				
Administracion Nacional de Combustibles, Alcohol y Portland (ANCAP)	Montevideo	25,200	SCA	2,200C
Venezuela:				
Creole Petroleum Corp.	Amuay Bay [1]	84,000	S	—
	Caripito	70,000	SC	42,000T
Mene Grande Oil Co.	Oficina	300	S	—
Phillips Oil Co.	Santa Ana [2]	1,800	Wax	—
Shell: Colon Development Co. Ltd.	Casigua	1,000	S	—
	La Rivera	300	S	—
	El Calvario	300	S	—
Compania Shell de Venezuela Ltd.	San Lorenzo	45,000	S	—
	Cardon [3]	170,000	Comp.	25,000T
Sinclair Oil & Refining Co.	Puerto La Cruz	30,000	S	—
Texas Petroleum Co.	Tucupita	10,000	S	—
Venezuela Gulf Refining Co.	Puerto La Cruz	59,000	Comp.	9,500T
Yugoslavia:				
Government:	Rijeka	7,000	SLAC	600T
	Sisak [1]	3,200	S	—
	Bosanski Brod	2,800	SLC	500T

[1] 6,250 b/d refinery is under construction to include topping, asphalt and TCC units.

[1] 6,000 b/d Platformer now being erected, to be complete late 1954.
[2] 2,300 b/d atmospheric and vacuum distillation plant under construction.
[3] Installation of a new vertical upshot heater and additional fractionating and stripping columns with ancillary equipment has been completed.
[4] 6,600 b/d thermal reforming capacity, 24,000 b/d vacuum pipestill and a 34,000 b/d naphtha stabilizer under construction.
[5] 6,000 b/d Platforming unit being erected, to be complete early 1955.
[6] 5,000 tons per annum increase in gas boiling plant being erected.
[7] 9,200 b/d thermal reforming capacity.
[8] 9,200 b/d thermal reforming capacity, 9,000 catalytic reforming capacity, 4,800 b/d hydrodesulfurization unit under construction, to be complete early 1955.
[9] 4,100 b/d thermal reforming capacity, 6,100 visbreaking capacity.

U.S.S.R.
It is estimated that crude capacity now approximates 1,200,000 b/d.

[1] To increase capacity by 75,000 b/d, to be complete Oct. 1954. 11,000 b/d hydroformer under construction, to be complete January 1955.
[2] To increase production 3,200,000 pounds per year.
[3] 8,500 b/d thermal reforming capacity.

[1] Refinery being extensively expanded and modernized. 2,800 b/d thermal cracking unit, 1,000 b/d reforming unit under construction.

AUSTRALIA

THE

KWINANA CONSTRUCTION GROUP (PTY.,) LTD.

PASTORAL HOUSE, ST. GEORGE'S TERRACE, PERTH

an Association of British Companies

COSTAIN - JOHN BROWN LTD.
D.&C. & WILLIAM PRESS LTD.
KINNEAR MOODIE LTD.

who are constructing the

ANGLO - IRANIAN OIL COMPANY'S

KWINANA REFINERY

(WESTERN AUSTRALIA)

OIL COMPANY STAFF CHANGES

LEE N. HAUGEN has been elected vice-president and general manager of the Cit-Con Oil Corp. at Lake Charles, La. and F. M. Simpson has been named vice-president and general manager of Petroleum Chemicals, Inc., with headquarters in New York.

Mr. Haugen is moving to Lake Charles from Bartlesville, Okla., where he has had headquarters as vice-president of Cities Service Oil Co. Mr. Simpson, who has been chief executive of Cit-Con Oil Corp. since its organization, has resigned as president of Cit-Con to establish headquarters for Petroleum Chemicals, Inc., which was recently formed by Cities Service and Continental to engage in a wide range of petrochemical manufacturing and research activities.

G. C. TEMPLEMAN has been promoted to chief chemist of The Ohio Oil Company's refining department and J. A. Coddington has been made technical advisor. Both Mr. Templeman and Mr. Coddington will move to the general office at Findlay from Robinson, Ill.

Mr. Templeman joined Ohio in 1937 as a chemist at the Lovell, Wyo. refinery. He was transferred to the Robinson refinery in 1949, continuing his work as a chemist. Mr. Coddington started with the company as a chemical engineer at Robinson 16 years ago. He advanced to assistant process engineering supervisor in 1951.

ROBERT H. SCHOLL has been elected vice president, director and member of the executive committee and Harold G. Mangelsdorf a director of Esso Standard Oil Co. Former general counsel of the company, Mr. Scholl will be succeeded in that post by Einar B. Paust, who has been associate general counsel since 1951. Mr. Mangelsdorf, who was named general manager of manufacturing in November 1953, will retain that position.

Mr. Scholl joined Esso in 1937 from the law firm of Kellogg, Emery and Inness-Brown. A graduate of Princeton University and Columbia Law School, he was admitted to the New York bar in 1926. He is secretary of the American Petroleum Industries Committee.

Mr. Mangelsdorf joined Esso in 1934 at the Baton Rouge, La., refinery, where he subsequently became assistant general manager. He transferred to the Bayway refinery in Linden, N.J., as general superintendent in 1950 and was named general manager of East Coast manufacturing in 1952. He is a graduate of Kansas State College and Massachusetts Institute of Technology.

Mr. Paust was associated with the firm of Milbank, Tweed, Hope and Hadely before joining Esso in 1945 following service with the United States Navy. He is a graduate of Columbia University and Columbia Law School.

H. T. DODGE has been appointed general manager of The Texas Company's foreign operations department (Western Hemisphere and West Africa). He has been assistant to the vice president since 1947. He is succeeded in that position by C. W. Saville, manager (exploration) of the foreign producing department since 1952.

Mr. Dodge was employed by The Texas Company of Mexico Ltd. in 1920. In 1922, he was transferred to Texaco's Casper Works at Casper, Wyo., where he worked until 1925. He has worked in various managerial capacities for the company's domestic sales department, and in foreign operations for Texaco subsidiaries and affiliates in Belgium, Holland and the Philippine Islands.

Mr. Saville was employed in 1937 as a paleontologist by Colombian Petroleum Co. In 1940 he was transferred as a geologist to Texas Petroleum Co. and remained in Colombia until 1952, when he was named manager (exploration) of Texaco's foreign production department, with headquarters in New York.

R. G. ARNER, manager of Sinclair Refining Company's East Chicago, Ind., refinery, has been promoted to the newly created position of assistant to the vice-president in charge of manufacturing. He will co-ordinate refinery department relations with crude oil purchasing, pipe line transportation, research and marketing operations, particularly in respect to refineries at East Chicago, Ind., Wood River, Ill., and Sinclair, Wyo. His headquarters will be in the Sinclair Oil Bldg. now nearing completion in Chicago.

NACY W. McGEE has been transferred to Regina, Sask., and promoted to chief geophysicist, Canada, for Sohio Petroleum Co. Mr. McGee was employed as a geophysical supervisor in Regina in October 1950. He was transferred to Houston, Texas in April 1953 and in June 1953 became a geophysicist in Billings, Mont., the position which he left to move to Regina.

J. A. COGAN, formerly head of the coordination and petroleum economics department of Standard Oil Co. (N. J.), has resigned to become assistant general manager of manufacturing in charge of refinery planning for Imperial Oil Ltd., Toronto.

Mr. Cogan joined the Jersey organization in 1932 as a process engineer in the Esso Standard refinery at Baton Rouge, La., and then came to New York in 1934 to become a member of Jersey's manufacturing coordination group. He became assistant head of the coordination and economics department in 1945 upon his return to the company from the PAW, where he was associate director of the program division. He became head of the department two years later.

H. T. Dodge

R. G. Arner

J. A. Cogan

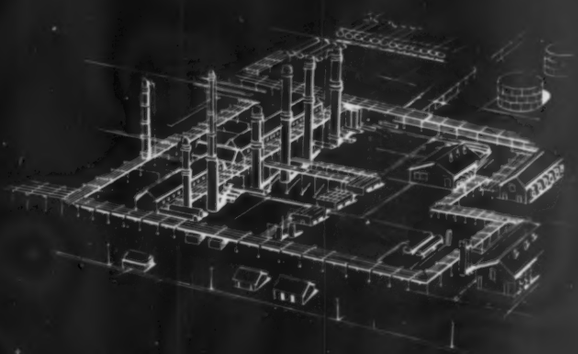
R. H. Scholl

H. G. Mangelsdorf

E. B. Paust

WYATT L. WALKER, Ponca City, senior process engineer in Continental Oil Company's headquarters manufacturing department, has been promoted to the newly created position of assistant chief process engineer. Mr. Walker joined Conoco at Ponca City in 1944 as a technologist and was promoted to senior processing engineer for the headquarters manufacturing department at the same location in 1951.

DAVID PROCTOR has been elected executive vice-president of Gulf Oil Corp. He has been a director, a vice-president, and general counsel for Gulf since 1945, and is a member of its top policy-making committees including executive, finance and management policy committees. He will continue as a director and general counsel for the parent company and for many of its subsidiaries.



entrust your fire problems to

THE

Pyrene

TRADE MARK

COMPANY LIMITED

"An investment in peace of mind"

The range of "Pyrene" Fire Fighting Equipment for Oil Refineries and Storage Installations includes

MECHANICAL FOAM GENERATORS
FOAM MAKING BRANCHPIPES
FIXED FOAM INSTALLATIONS
FOAM INDUCTORS
AND PROPORTIONATORS

FOAM TENDERS & TRAILERS
FOAM MONITORS
and other forms of portable foam and CO_2 fire fighting equipment

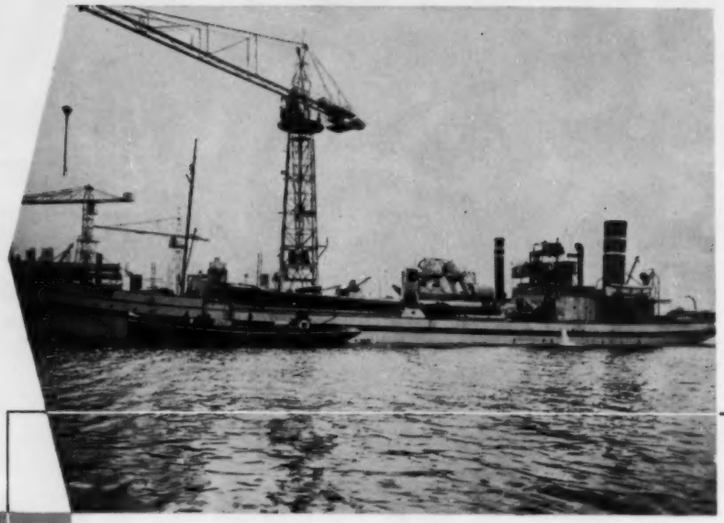
FIRE EXTINGUISHERS
A wide range, using every proved fire extinguishing medium

Full Information from Dept. W.P.7 **THE PYRENE COMPANY LTD** 9 GROSVENOR GARDENS, LONDON, S.W.1

Telephone VICTORIA 3401 *Cables* PYRENE—LONDON

H. A. M.

DREDGERS DO AWAY WITH SANDBANKS AT NEW AUSTRALIAN OIL-PORT



"One of the Company's floating rockbreakers"

Two vast sand banks formed an annoying obstacle in the main access channel to the loading jetties of the new oil refinery in Kwinana, Western Australia. To enable tankers of considerable tonnage to navigate here without difficulties these approaches would have to be widened and deepened. On behalf of the Western Australian Government this job is now being carried out by suction hopper dredgers of the Hollandse Aanneming Maatskappy S.A. (Eiëndoms) Beperk. By the time they are through these craft will have removed seven million cubic yards of sand in a swift, practically non-stop tempo.

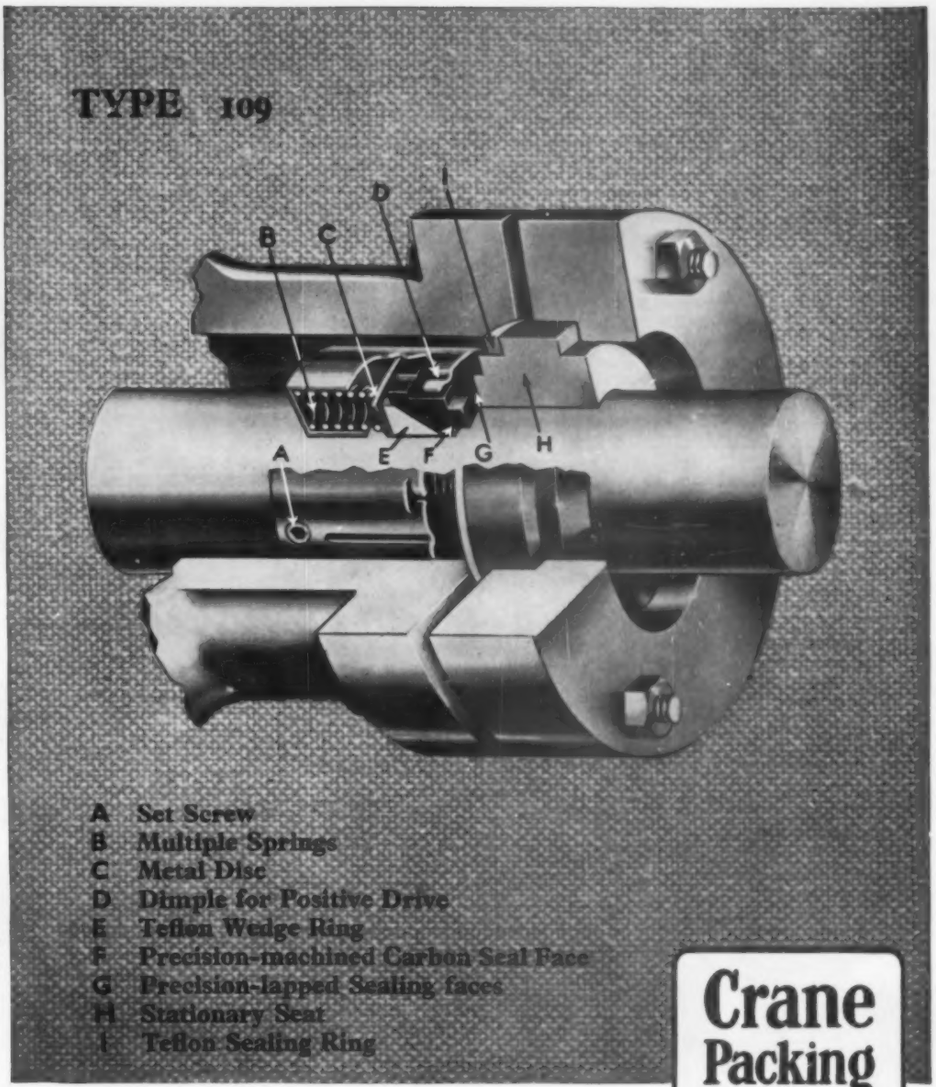
This exemplifies the way in which many of such operations all over the globe are being tackled by units of this company's fleet of dredging equipment. For any job in dredging, reclaiming and submarine rockbreaking apply to the H.A.M. They will gladly submit offers and supply the needed information.

H. A. M.

HOLLANDSE AANNEMING MAATSKAPPY

HEAD-OFFICE:	HOLLAND OFFICE:	LONDON OFFICE:
CAPE TOWN	THE HAGUE	c/o K. L. KALIS SONS & Co. Ltd.
P.O. BOX 1768	GROOT HERTOGINNELAAN 218	STONE HOUSE, BISHOPSGATE-LONDON E C 3

A Mechanical Shaft Seal



for High Temperature & Corrosive Services

Crane Packing LTD OF SLOUGH ENGLAND A COMPANY

This Type 109 Mechanical Shaft Seal will seal off corrosive fluids or gases which are being handled at temperatures up to 485° F. and at pressures up to 750 p.s.i. on such applications as centrifugal pumps, turbines, positive displacement pumps, agitators, etc. It is the first Seal of its kind to be manufactured in this country—it is precision engineered and corrosion resistant materials can be used for each component.

In order to impart to the assembly the required degree of flexibility a flexible wedge ring is used (see "E" on diagram). The new chemically inert polymerised plastic fluorethylene known as Teflon in the U.S.A. and as Fluon in this country, is the material from which this wedge ring is formed by means of special moulding and machining processes. All metal parts can be of stainless steel, or special alloys, depending on the nature of the service conditions.

Interested Engineers are invited to send for illustrated literature describing the Type 109 Mechanical Shaft Seal.

This is one of the many mechanical shaft seals which we manufacture for a wide range of services. We manufacture this design of seal by agreement with the Crane Packing Co. of Chicago, U.S.A.

CRANE PACKING LIMITED, SLOUGH, BUCKS.

C. P. BOUTTE has been appointed chief engineer at Shell Chemical Corporation's new chemical plant now under construction at Norco, Louisiana, F. E. Caddy, plant manager, has announced.

Mr. Boutte will serve as construction superintendent during current construction at the Norco plant, which is expected to be completed in early 1955. In this capacity he will succeed R. K. Walters, who has been appointed assistant manager of the manufacturing-engineering department at the company's head office in New York.

PIERCE MARION has retired after more than 36 years of service with Tide Water Associated Oil Co. He has been secretary to the eastern division operating committee and assistant to the vice president and chairman of the eastern division operating committee.

H. O. CAMERON has been appointed assistant to Sun Oil Company's vice president in charge of production. Mr. Cameron has been manager of the company's Michigan production division.

Mr. Cameron, well-known and active in petroleum circles for half a century in Toledo, is president of the Bay Terminal Railroad there.

George W. Myers, formerly assistant division manager, now becomes manager and F. H. Latimer assistant manager. They also are located in Toledo.

Mr. Myers joined Sun in 1917 as a geologist and landman in Ohio, becoming chief geologist of the Michigan division and later assistant manager.

Mr. Latimer joined Sun in 1938 as a geologist in Evansville, Ind. He was transferred to the geological staff in Philadelphia in 1947 and since 1951 has been assisting Mr. Myers in Toledo.

C. L. Burrill

C. L. BURRILL has been appointed chief economist of Standard Oil Co. (N. J.), a new position to coordinate economic studies for the directors. Since March 1, when he returned to Jersey after serving as vice-president of Creole Petroleum Corp., Mr. Burrill has been manager of the general economics department. He is succeeded in that post by his former assistant, R. W. Adams, as acting manager. Mr. Burrill came with Jersey Standard in 1940 from the faculty of the Harvard Business School. Prior to joining Creole in 1949, he was head of Jersey's budget department.

KLASS DIJKHUIZEN has been appointed managing director of Netherlands Sun Oil Co. He succeeds the late Gerrit van Wageningen.

Mr. Dijkhuizen's connection with the oil industry began in 1922 when he joined the office staff of N. V. Rotterdamsche Olie Import Maatschappij, a company which became a wholly-owned subsidiary of Sun Oil Co. in 1936.

He is a director of the Netherlands Sun Oil Co. and has served as that company's proxy and office manager for several years, and is also a director of the Belgian Sun Oil Co., S.A.

EMILIO G. COLLADO, assistant treasurer of Standard Oil Co. (N.J.) since January 1949, has been elected treasurer to succeed Leo G. Welch, who has been a director of the company since last year.

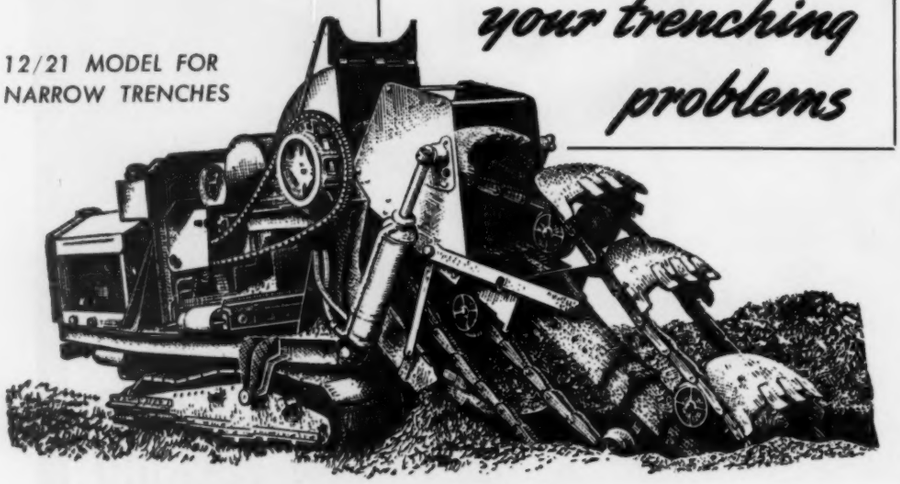
Mr. Collado came to Jersey Standard in 1947 from the International Bank for Reconstruction and Development where he served as United States executive director. Previously, he was with the State Department in Washington from 1938 through 1946; the Federal Reserve Bank of New York from 1936 through 1938; and the Treasury Department from 1934 through 1936.

H. H. BYBEE has been appointed division geologist for Continental Oil Co. with headquarters at Midland, Texas. Formerly division geologist at Wichita Falls, he succeeds C. D. Vertrees, Midland, who was recently promoted to region research geologist. Max Levin has been promoted to Midland district geologist. He will continue to make his headquarters at Midland.

MONTY G. MARTIN has been appointed chief geologist for the Texas Gas Transmission Corp. gas supply department, Shrevport, La. He formerly was chief geologist for Southwest Natural Production Co.

The answer to all your trenching problems

12/21 MODEL FOR NARROW TRENCHES

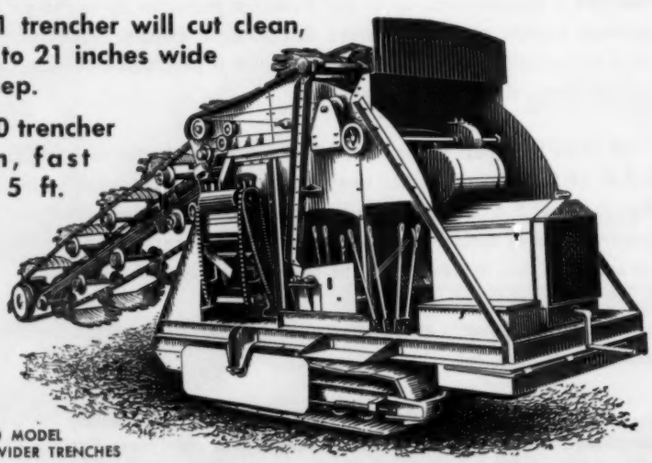


ALLEN *Super Duty* TRENCHERS

World-renowned, all-British ALLEN plant is recognised as the finest obtainable. For hard work, long life, freedom from breakdown and economical maintenance, it has no equal anywhere.

The Model 12-21 trencher will cut clean, fast trenches 13 to 21 inches wide down to 6 ft. deep.

The Model 16/60 trencher will cut clean, fast trenches up to 5 ft. wide down to 14 ft. deep.



Illustrated catalogues sent on request.

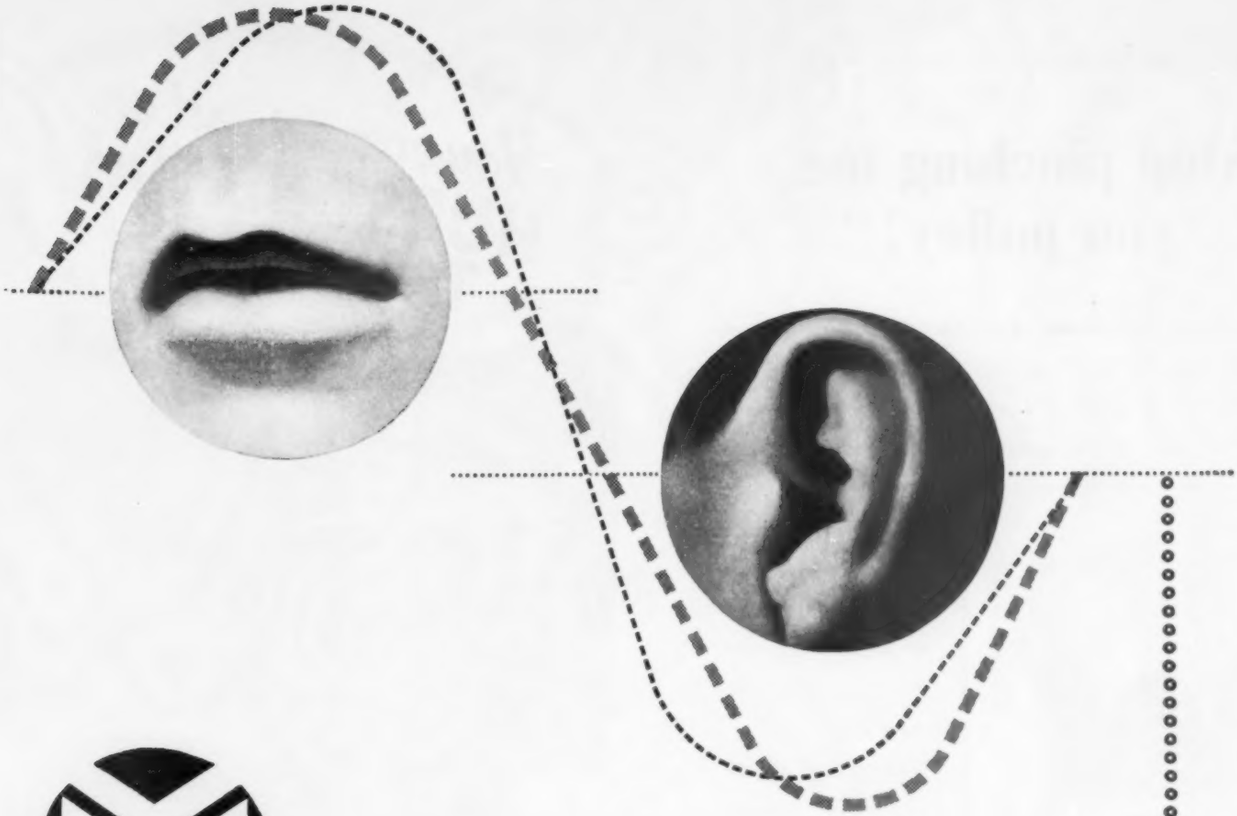
16/60 MODEL FOR WIDER TRENCHES

JOHN ALLEN & SONS (OXFORD) LTD. COWLEY OXFORD ENGLAND

GLASSES & GASKETS ALL SIZES TO FIT YOUR GAGES & VALVES

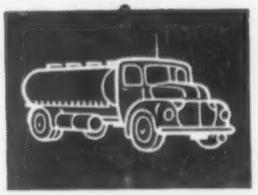
ERNST WATER COLUMN & GAGE CO.

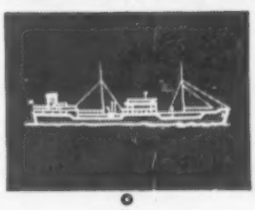
Send for Catalog, LIVINGSTON, N.J.



RADIO-TELEPHONE SCHEMES

In more than fifty countries Pye V.H.F. Radio-Telephones are providing an economical and reliable means of instantaneous communication between fixed points, between mobile units, and between fixed points and mobile units. Over two-thirds of the equipment in use in Great Britain alone has been produced by Pye. The Pye Systems Department will be pleased to advise you on your communications schemes whilst Pye agents and representatives overseas will demonstrate, install and maintain the equipment.





Telecommunications

Pye (New Zealand), Ltd., P.O. Box 2839, Auckland C.1., New Zealand.

Pye Canada, Ltd., Ajax, Ontario, Canada.

Pye-Electronic Pty., Ltd., 65 Park Street, Abbotsford, Melbourne, Victoria, Australia.

Pye Ireland, Ltd., Manor Works, Dundrum, Dublin, Eire.

Pye Radio & Television (Pty.) Ltd., P.O. Box 10648, Johannesburg, South Africa.

PYE LIMITED · CAMBRIDGE · ENGLAND

IF ROPE COULD TALK . . .

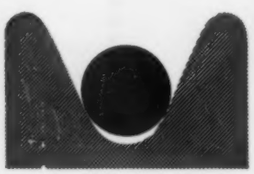
"Stop pinching me, you pulley!"

You can't punish ropes and expect to get the best out of them. So watch your PULLEYS and SHEAVES.

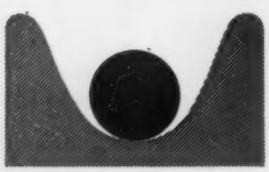
The radius of the groove of a pulley should always be slightly larger than that of the rope passing over it. If the groove is too narrow, it will crush the rope and soon damage the wires.

If too wide, the rope not only wears more quickly at the point of contact but also cuts a false groove in the pulley.

With sheaves, oil the bearings at frequent intervals and check that they rotate freely. A seized up sheave can ruin a rope very quickly. Watch alignment too; see that sheaves, drums and pulleys are set exactly in line with the rope that is working over them.



WRONG
Pulley groove too narrow.



WRONG
Pulley groove too wide.

RIGHT
Pulley groove correct—supporting the rope for 1/3rd. of its circumference.

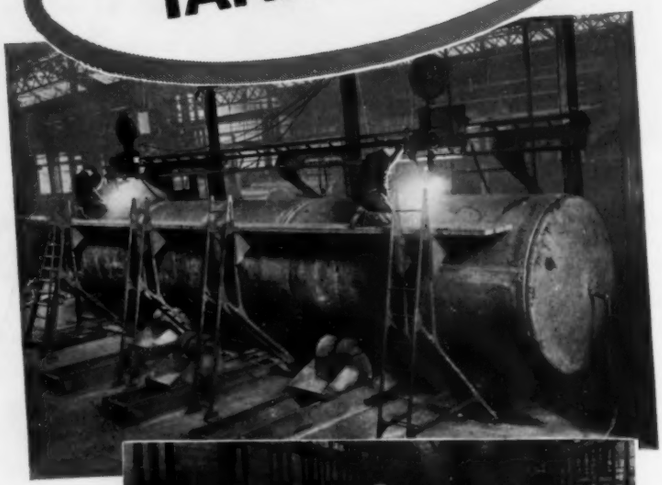
Write for a copy of a new booklet "If Rope could Talk."

Pin up this announcement where your staff can see it. It is issued in the interests of longer rope life by

British Ropes Limited

HEAD OFFICE: DONCASTER
EXPORT SALES OFFICE: 52 HIGH HOLBORN, LONDON, W.C.1

You can depend on
HURST-NELSON TANK CARS

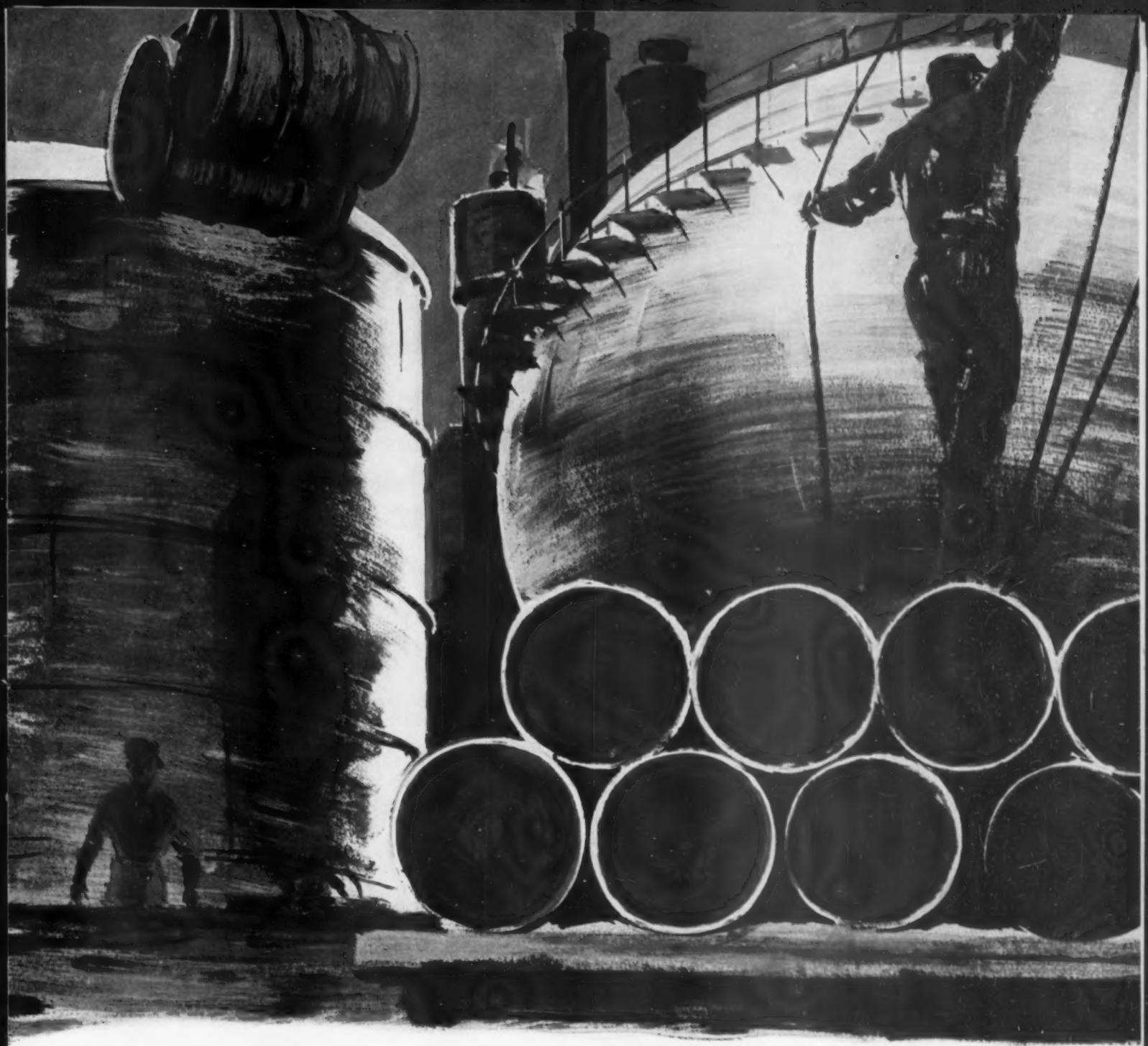


We design and build Tank Cars to meet variations in the factors of volatility, viscosity and all other properties of the liquids to be transported; we fit them also to suit all types of terminal loading and discharging facilities at installations. Our service can meet your precise requirements.

We invite your enquiries.

HURST-NELSON & CO LTD

Designers & Builders of Railway Rolling Stock
HURST, NELSON & CO. LTD., MOTHERWELL, SCOTLAND
Telephone Motherwell 500. Telegrams 'Nelson' Motherwell.
London Office: 30 Ashley Place, London, S.W.1. Tel. Tate Gallery 0404.

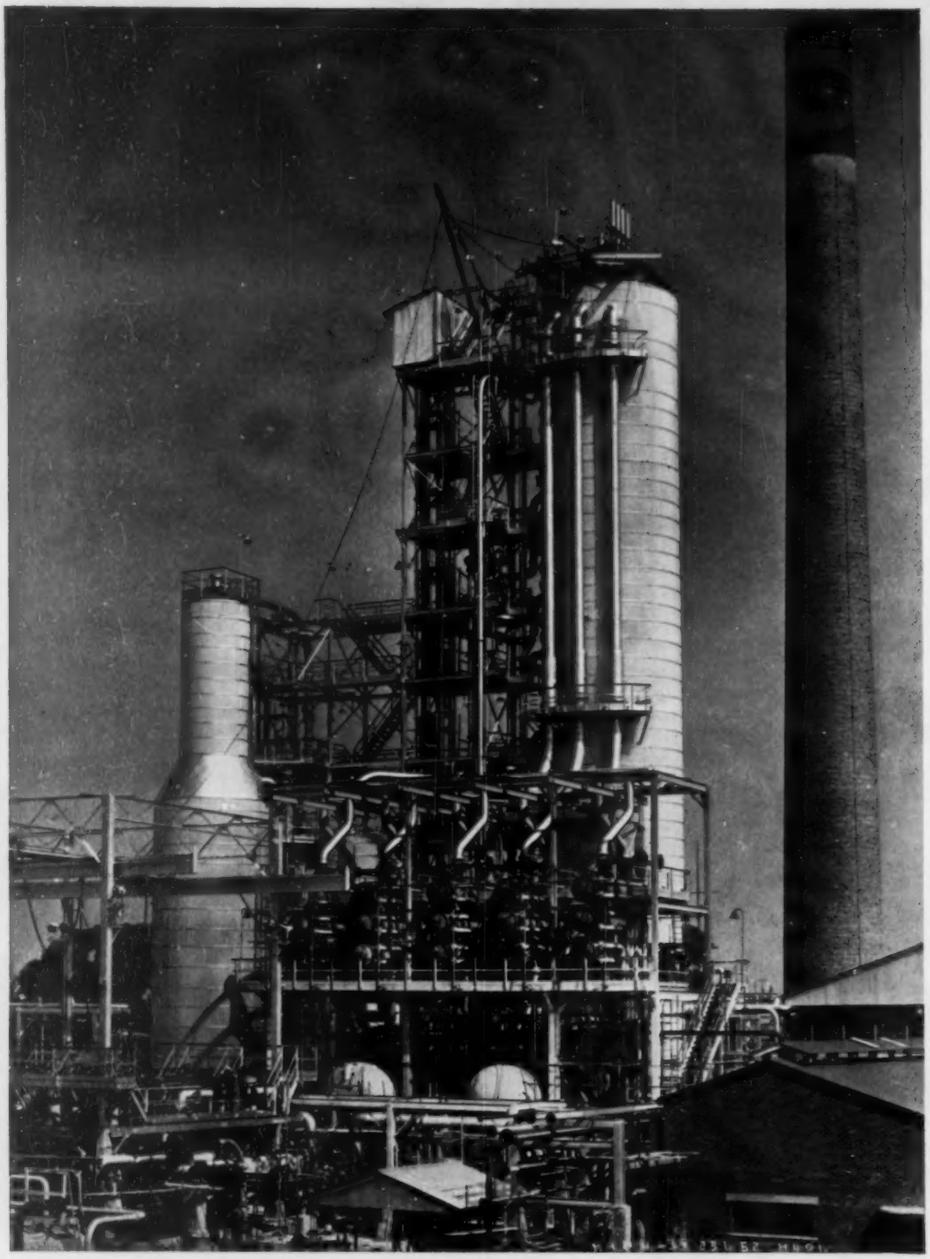


Confidence — the reward of decades

BOILERS DRUMS AND BARRELS

The successful practical application of the results of technological advance for the benefit of industrial production depends largely on an adequate supply of oil fuels and lubricants. These, in fact, play a vital part in ensuring the high living standards of modern civilization.
The refining procedure to which crude oil is subjected in order to obtain power fuels and lubricants, requires highly complicated chemo-physical processes which are characterized by ever increasing service pressures and temperatures.
These processes became practicable only with the invention of the famous Mannesmann seamless steel tube about six decades ago. A definitely superior product even then, it has been progressively developed and perfected ever since.
In equipment for the transportation and storage of oil fuels and lubricants, Mannesmann has long been enjoying a world-wide reputation as supplier of a full range of pipe lines, boilers, drums, barrels, cylinders and containers in virtually every form to suit each and any particular requirement.

MANNESMANN-EXPORT GMBH DÜSSELDORF



TOPPING UNIT, A.I.O.C. KENT REFINERY, ISLE OF GRAIN

MANAGING CONTRACTORS: MESSRS E. B. BADGER LTD.

MECHANICAL & ELECTRICAL CONTRACTORS: GEORGE WIMPEY & CO. LIMITED

WIMPEY

BUILDING, CIVIL, ELECTRICAL and MECHANICAL ENGINEERS

To:

ANGLO-IRANIAN OIL COMPANY
ANGLO-SAXON PETROLEUM COMPANY
ASSOCIATED ETHYL COMPANY
BRITISH MALAYAN PETROLEUM COMPANY
ESSO PETROLEUM COMPANY LIMITED
IRAQ PETROLEUM COMPANY
KUWAIT OIL COMPANY
SARAWAK OILFIELDS COMPANY
STANDARD VACUUM OIL COMPANY

.....

OVERSEAS AT:

PORTUGAL · IRAQ · HONG KONG
CYPRUS · KUWAIT · BORNEO
SIERRA LEONE · ADEN · SUMATRA
GOLD COAST · PAKISTAN · EGYPT
AUSTRALIA · MALAYA · JAMAICA
SYRIA · SINGAPORE · SOUTH AFRICA

THE WIMPEY ORGANISATION HAS SUCCESSFULLY CARRIED OUT EVERY ASPECT OF WORK CONNECTED WITH OILFIELD DEVELOPMENT, REFINERIES AND OIL PORT INSTALLATION AT HOME AND OVERSEAS

GEORGE WIMPEY & CO., LIMITED, HAMMERSMITH GROVE, LONDON, W.6

International Paints

in Australia

At Sydney an associated "International" factory is making paints for a great variety of purposes. Their intimate understanding of paints suitable for the Australian market contributes in no small measure to the wealth of knowledge accumulated by "International's" world-wide organisation.

"International" have associated Companies in 15 other countries and close co-operation ensures the ability to supply the right paint for anything, anywhere. "International" products for the oil industry include METAL PRIMERS and ALUMINIUM PAINT for storage tanks; DRUM PAINTS, and ENAMELS for general purposes.

International Paints Ltd.

Head Office: GROSVENOR GARDENS HOUSE, LONDON, S.W.1

TELEPHONE: TATE GALLERY 7070 (15 LINES)

TELEGRAMS, INLAND: CORROFOIL, SOWEST, LONDON. OVERSEAS: CORROFOIL, LONDON

REGISTERED TRADE MARK

MAIN FACTORY IN U.K. FELLING-ON-TYNE

ASSOCIATED FACTORIES IN

AUSTRALIA	SYDNEY	GERMANY	HAMBURG	NEW ZEALAND	WELLINGTON
BRAZIL	RIO DE JANEIRO	ITALY	GENOA	SPAIN	BILBAO
CANADA	MONTREAL	ITALY	TRIESTE	SWEDEN	GOTHENBURG
CANADA	VANCOUVER	JAPAN	KOBE	U.S.A.	NEW YORK
DENMARK	COPENHAGEN	MEXICO	MEXICO CITY	U.S.A.	SAN FRANCISCO
FRANCE	LE HAVRE	NORWAY	BERGEN	VENEZUELA	MARACAIBO

gives as good as it gets . . .

. . . that's the Paxman "package" diesel drilling set. Built by practical men who know site conditions at first hand, these "package" sets will be driven across rough country, rolled off lorries, and dragged to the site in rough and ready fashion. They're built for rough handling and, like the men who operate them, they can take it without falling down on the job. Paxman sets are suitable for incorporating in any make of rig, whether British or American and are made in a power range from 130-665 s.h.p.

PAXMAN

DIESEL ENGINES FOR OIL WELL DRILLING

DAVEY PAXMAN & CO LTD COLCHESTER *associated with Ruston & Hornsby Limited Lincoln*

MOBILE AIR COMPRESSORS

EXTREME INTERCHANGEABILITY THROUGHOUT THE RANGE CONSIDERABLY REDUCES THE FLEET OWNER'S SPARE PART PROBLEMS AND CUTS EXPENSES.

LOW AIR TEMPERATURE INCREASES LIFE OF ALL VALVES, WORKING PARTS AND PNEUMATIC TOOLS.

HIGH EFFICIENCY UNDER EXTREME WORKING CONDITIONS IN ALL CLIMATES GIVING RELIABLE UNINTERRUPTED PERFORMANCE.

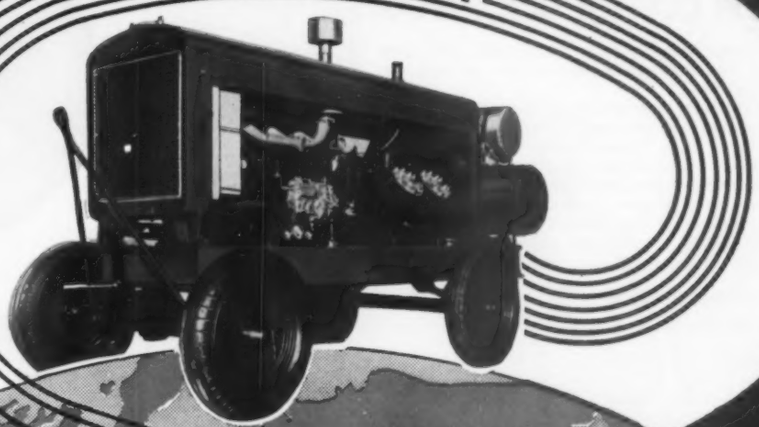
AIR PUMPS MOBILE AIR COMPRESSORS OPERATING AT THE SITE OF THE NEW ANGLO-IRANIAN OIL REFINERY AT ADEN Include:—

105, 210, 250, 315 & 500

c.f.m. Free air delivered

SUPPLYING THE WORLD'S NEEDS FOR

COMPRESSED AIR



AIR PUMPS LTD

BUSHEY ROAD · RAYNES PARK · LONDON · ENGLAND

TELEGRAMS: AIRPUMPS, WIMBLE, LONDON

Sales Dept. 8 FRANCIS ST., VICTORIA ST., LONDON, S.W.1. Telephone: VIC 5878-9 Grams: AIRPUMPS, SOWEST, LONDON

AGENCY OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

There is no hazard of fire when using

BERYLLIUM COPPER (TELCON BRONZE) TOOLS

All industries which have fire or explosion risks need Safety Tools made of Telcon Bronze because of their non-sparking, non-magnetic qualities.

Telcon Bronze can be bent or worked to intricate shapes in its soft condition and subsequently hardened so that it is almost as tough and strong as steel. Telcon Bronze Tools have a great resistance to fatigue. There are over 300 different Telcon Bronze Tools, including centre punches, spanners, chisels, scissors, saws, shovels, hammers, drills, scrapers, picks and pneumatic piercing bits. Telcon Bronze is also used for metal nails and tips on the clogs of those engaged in the petroleum industry.

Send today for details of tools manufactured in this essential material to:

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD

All enquiries to: **Telcon Works, Greenwich S.E.10** *Tel: GREenwich 3291*

minimum steam consumption

"Hall" Boiler Feed Pumps are designed to make use of every unit of steam energy before it is passed to exhaust. Over 50 years of specialist experience is behind these pumps which are made from first class materials.

HALL BOILER FEED PUMPS

Of the Vertical Single Cylinder Direct and Double Acting type, the standard range of Hall Pumps covers capacities from 250 to 10,000 gallons per hour.

J. P. HALL & SONS LTD., PETERBOROUGH, ENGLAND

P3836

CHRISTIANI & NIELSEN LTD.

CIVIL – ENGINEERING – CONTRACTORS

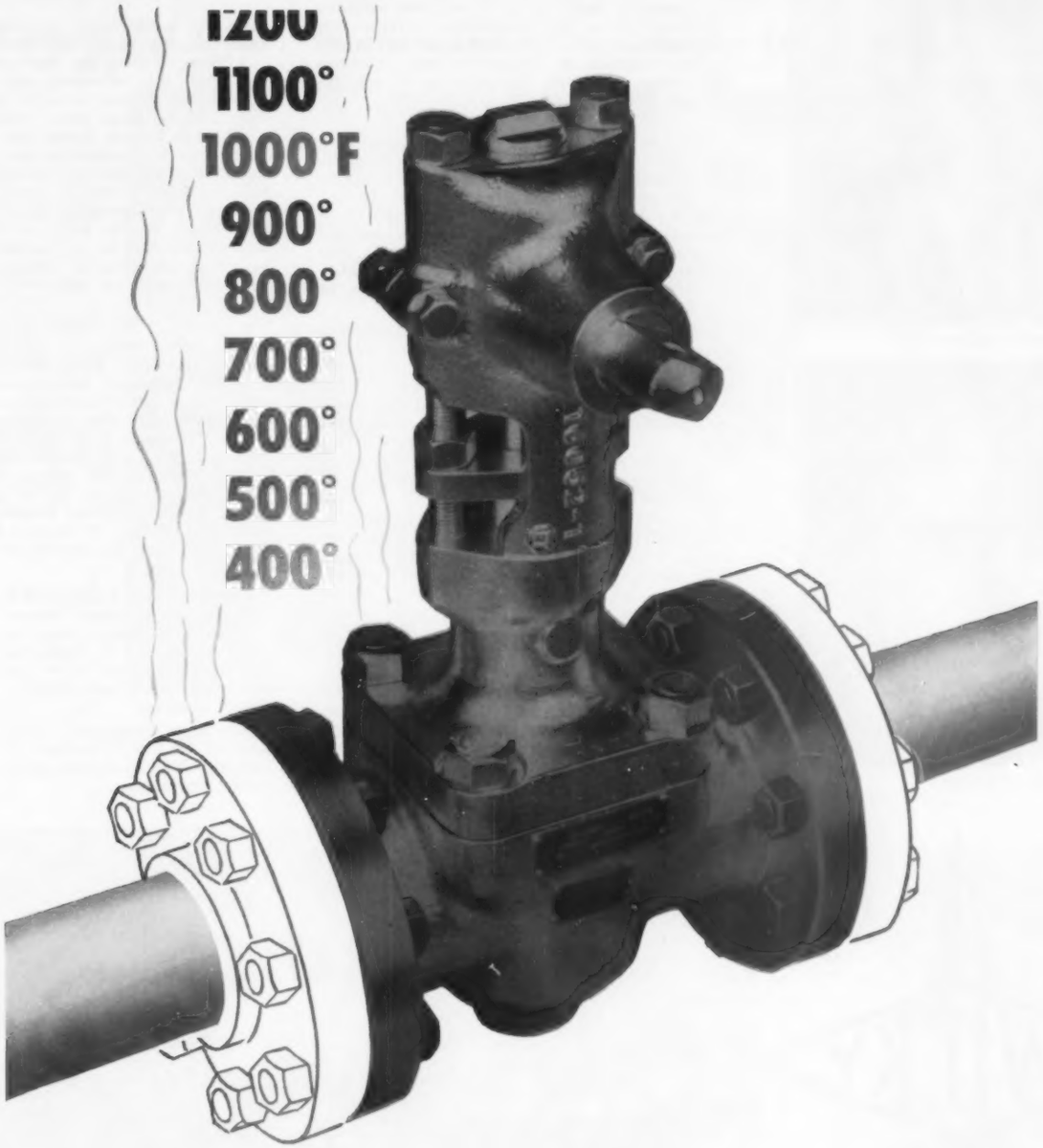
DESIGNERS OF THE MARINE FACILITIES AT KURNELL REFINERY, BOTANY BAY, AUSTRALIA

FOR

AUSTRALIAN OIL REFINERY (PTY.) LTD.

ROMNEY HOUSE, TUFTON STREET, LONDON S.W.1

Tel. Abbey 6614-7 **Telegrams: Reconcret Sowest**



Cameron

Lift-Plug Valves are ideal for high temperature service. They require no lubrication to effect a seal. They require no lubrication for easy operation. Their advanced design employs a seat which is separate from and not attached to the body, is not affected by body distortions resulting from elevated temperatures or line pressures.

The standard Cameron High-Temperature Valve is recommended for temperatures ranging up to 1000° F. Using special materials, these valves are performing satisfactorily at 1600° F.

Cameron

IRON WORKS, INC.
P. O. Box 1212, Houston, Texas
EXPORT OFFICE: 7912 EMPIRE STATE BLDG., NEW YORK CITY

Whatever Your Valve Problem, Contact Cameron — A World Leader In Pressure Control

J. A. Doctor

H. F. Parsons

JAMES A. DOCTOR has resigned from Continental Oil Co., Ponca City, Okla., to become vice president and director of marketing for the Chicago Corp. A. E. Tranor, vice president of Champlin Refining Co., Enid, will continue to direct all of the marketing activities for Champlin. In addition he will assist Mr. Doctor in co-ordination of Champlin's and Chicago's marketing activities. Champlin is a wholly-owned subsidiary of Chicago.

WILLIAM E. WALLIS, geological department manager for the Creole Petroleum Corp. in Venezuela, has been appointed deputy manager of exploration for Standard Oil Co. (N. J.), effective August 1. Mr. Wallis was geologist in Mexico for the Huasteca Petroleum Co. for nine years. In 1939 he moved to the Eastern Hemisphere and undertook geological and geophysical work with the Standard Oil Co. of Egypt.

After a brief spell with Jersey's producing department in New York in 1942, Mr. Wallis was transferred to Costa Rica and Cuba for two years, then returned to Egypt as chief geologist in 1945. His next appointments were as exploration manager, and later as general manager, in Ecuador with the International Ecuadorean Petroleum Co. and then as chief of exploration in Peru for the International Petroleum Co. for one year.

In January 1948 he transferred to Creole in Venezuela as assistant manager in the geological department, and rose to manager in the same year. Since that time, Creole's exploration work has been in his hands during a very active period in the company's history.

HAROLD F. PARSONS, assistant vice president of Tide Water Associated Oil Co. and manager of the New York crude and products section, retired June 30 after more than 36 years of continuous service with the company. He also retired as chairman of The Tide Water Pipe Co. Ltd. and vice president of the Bradford Transit Co.

Current Developments in Refinery Waste Disposal

(Continued from page 138)

to go to work again in removing phenol or other organic waste material from the water.

Although Sun is the first petroleum refinery to install this advanced process, it has been successfully proved in operation by other industries and by large cities. Also, it is reported that three United States oil companies have been operating experimental plants; and Imperial Oil Limited is making a commercial installation at its Sarnia plant. Imperial's unit includes arrangements for flue gas stripping of sulfides in the waste water prior to biological oxidation in steel tanks. An aero-accelerator is employed to inject air directly into the water with no pressure.

Acknowledgment

The author wishes to express his appreciation to Harold F. Elkin, Sanitary Engineer of Sun Oil Company, who reviewed this article and offered numerous helpful suggestions; and to acknowledge the American Petroleum Institute's Manuals I, II, and III on Disposal of Refinery Wastes as the source of much information cited in this paper. The author was aided particularly in the preparation of this report by Dr. Matthew H. Hohn of the Philadelphia Academy of Natural Sciences and by D. B. Ardern of Houdry Process Corporation.

GEORGE E. ESSELBORN has retired as manager of Standard-Vacuum Oil Company's product procurement and bunker oil department and Elmer J. Smith has been appointed manager of its new bulk supply and distribution department, with William C. Gower as assistant manager.

The new department is a merger of the functions of the former product procurement group and Mr. Smith's former statistical and distribution department.

ZWICKY

Aircraft

SERVICING TROLLEY

The picture illustrates a Zwicky Methanol Replenishment Trolley servicing a Vickers 'VISCOUNT' at London Airport. Our range of Trolleys is complementary to our Aircraft Refuelling Units and includes Oil System Flushing, Replenishing, De-icing, Water-Methanol Trolleys and Fresh Water and Sanitary Services.

ZWICKY of SLOUGH

ZWICKY LTD., TRADING ESTATE, SLOUGH, BUCKS, ENGLAND. *Telegrams & Cables:* "ZWIKLIM, SLOUGH"

THE MOTHERWELL BRIDGE CONTRACTING AND TRADING CO. LTD.

Contractors to Governments and Oil Companies in the Middle East

HEAD OFFICES

CONTRACTING AND TRADING CO.
P.O.B. 1036,
Beirut, Lebanon

MOTHERWELL BRIDGE CONTRACTING AND TRADING CO. LTD.
P.O.B. 37, Tripoli

PRINCIPAL OFFICES & BRANCHES:

Beirut, Tripoli, Damascus, Homs, Baghdad, Basra, Kuwait, Bahrein, Qatar, Trucial Coast, Aden, Jedda, Amman and Benghazi

LONDON OFFICES:

85, Lancaster Gate, W.2.
Tel. No.
Ambassador 5081

82, Victoria St., S.W.1,
Tel. No. Victoria 4183

TANK FARMS, PIPELINES, POWER STATIONS, AIRFIELDS, GOVERNMENT BUILDINGS ETC.

Complete refinery instrumentation now available from a *single source*

ELLIOTT BROTHERS (LONDON) LIMITED provide an unrivalled service for the instrumentation and control of refineries, combining the best elements of process control instrumentation practice in Britain and America. Their unparalleled experience amassed over 150 years of continuous development is augmented by valuable designs and manufacturing techniques from the two leading American companies in this field, The Bristol Company and the Fisher Governor Company, whose products find universal acceptance. The new arrangements made by Elliott Brothers (London) Ltd. for producing these in Britain mean that Process Control facilities previously obtainable only as dollar imports are readily available.

Write for full details to

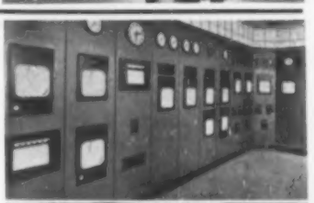
ELLIOTT BROTHERS (LONDON) LTD., CENTURY WORKS, LEWISHAM, LONDON, S.E.13

acting in conjunction with their Subsidiary Companies

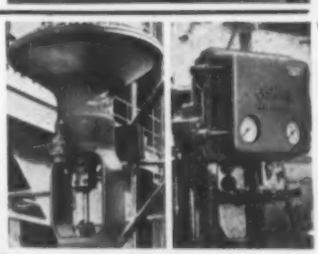
BRISTOL'S INSTRUMENT COMPANY LTD. · FISHER GOVERNOR COMPANY LTD.

ELLIOTT *Drimac force-balance transmitters have been installed in the Thermofor Continuous Percolation plant at Coryton Refinery to control oil flow, fuel gas flow, and to measure differential pressure. In refinery installations all over the world the Elliott Drimac has rapidly gained universal acceptance.*

BRISTOL'S *equipment includes recording, controlling, indicating, transmitting and integrating instruments for use on the water-treating plant, the propane de-asphalting unit, and on turbo-generators. Off-site instruments recording the supply of city water to the refinery and controlling the intake of cooling water are among other installations. These two illustrations show views of control room panels in the water-handling and treatment plant at Coryton Refinery.*



FISHER 10" *Valve with giant topwork and "Positrol" positioner to control back pressure in a line from a continuous blow-down tank is shown right. Level-Trols have been used exclusively on process plant. A Level-Trol on the gas knockout drum of the gasoline treating unit is illustrated on the far right.*



Photographs are by courtesy of Vacuum Oil Company Ltd. and The Lummus Company Ltd.

Information you can't afford to miss!

G.E.C. FLAMEPROOF SWITCH FUSES

Information you can't afford to miss is contained in Switchgear Bulletin X2497. Send for your copy now.

G.E.C. Flameproof Switch Fuses for use in situations where flameproof enclosures are necessary, fully comply with BS229/1946 (Flameproof enclosures of electrical apparatus) and BS861 (Air-break switches). Certified by the Ministry of Fuel and Power for use in gases in Groups 1, 2 and 3.

G.E.C.

THE GENERAL ELECTRIC CO. LTD · MAGNET HOUSE · KINGSWAY · LONDON · W.C.2

Thermal loss is expensive

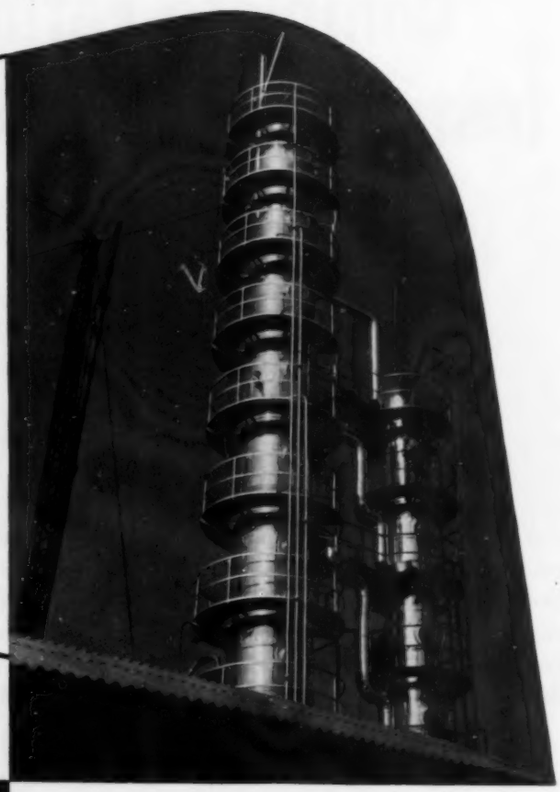
Pipe insulation with economical long-fibred "SILLAN"-Rockwool. Quilts and pre-cast rigid sections for refinery pipe systems and apparatus.

The importance of SILLAN-Rockwool is clearly demonstrated by the fact that it is used with outstanding efficiency for temperatures ranging from -300° F up to + 1300° F.

Having at our disposal a large number of erectors who have all been well trained in this branch in accordance with our 75 years of practical experience, we can also offer our service for the application of our materials.

ISOLIERUNG

Write for full details.



Z A · M A

GRÜNZWEIG + HARTMANN AG · LUDWIGSHAFEN · RHEIN GERMANY

REFINEMENT *IS THE* KEYNOTE

From THORNCLIFFE

Across the world, discerning refinery and process engineers recognise the technical skill and craftsmanship which Newton, Chambers bring to the making of specialised plant. At Thorncliffe, whilst keeping abreast of tomorrow's trend in technique, we refresh ourselves constantly from a back-log of experience spanning 160 years, and more, of service in the engineering field.

This is a Stripping Tower for one of the Aden Crude Topping Units and has been constructed to A.P.I. A.S.M.E. Code. It has a diameter of 5'6", its overall length is 62'2", and it weighs 17 tons. (Photograph by permission of Messrs. E. B. Badger & Sons Ltd., and Anglo-Iranian Oil Co., Ltd.)

To ADEN

NEWTON CHAMBERS

& CO. LTD. THORNCLIFFE Nr. SHEFFIELD

Pacific Northwest Chemical and Fertilizer Plant

Columbia River Chemicals, Inc. will construct a $12 million chemical and fertilizer plant in the Pacific Northwest. The plant will be located on a 50-acre site under lease from the Walla Walla Port Commission, 13 miles from Pasco, Washington, on the Columbia River. First major project of its kind in the Northwest, the plant will produce 160 tons per day of anhydrous ammonia, 110 tons per day of urea, and 140 tons per day of ammonium sulfate. The synthetic ammonia plant will be designed to generate hydrogen from bunker "C" fuel oil for combination with nitrogen from the air. The plant will also be designed to use natural gas as raw material at such times as it is available in the area. The Fluor Corp. Ltd. will design and build the plant.

Centrifugal Pump Specifications

A tentative specification for centrifugal pumps for general refinery services has been issued by the American Petroleum Institute. The publication is designated as API Standard 610 and is designed to simplify the purchase of these items of equipment. The publication covers designs, materials, inspection and test directions for preparing pumps for shipment and an outline of drawings and other data are also included. The price is $1.50 per copy.

Welding Book

The latest developments in the science of welding aluminum are described by the Aluminum Company of America in the completely new book "Welding Alcoa Aluminum." Photographs and drawings are coupled with the comprehensive text to illustrate all the practical methods for welding aluminum. These include torch welding, arc welding (including inert-gas shielded arc welding), resistance welding, and pressure welding.

C. A. Maxwell

Maxwell Joins Lummus

Carl A. Maxwell has joined The Lummus Co. as a power plant consultant. He was formerly associated with Babcock & Wilcox. He spent four years as superintendent of the erection department of Fuller Lehigh Co., a subsidiary of Babcock & Wilcox; seven years as assistant superintendent of the Babcock & Wilcox erection department; one year as marine superintendent of erection; and 14 years as superintendent of erection.

Maintenance Bulletin

A new publication, "Five Steps to Productive Maintenance," is available from the General Electric Co., Schenectady 5, N.Y. The 18-page bulletin, GEA-6087, provides detailed information on organizing to meet the demands that automation make on an electrical maintenance program.

La Quinta Alumina Plant

(Continued from page 128)

area occupies 120 acres. Site preparation involved the moving and compacting of 750,000 cubic yards of earth and the building of Red Mud Lake, 80 acres in area. Some 60,000 cubic yards of concrete were poured. Seven thousand tons of structural steel went into the buildings, pipeways and other structures. In all, over 4,000 carloads of materials and equipment were delivered to the job site and installed in the plant. The first units were ready for startup within 14 months from the release date.

Some measure of La Quinta's significance to the American economy may be gained by a simple comparison. Total national production of alumina before World War II was about 400,000 tons annually. La Quinta's production today, 365,000 tons, is equivalent to better than 90 percent of the nation's needs in 1939.

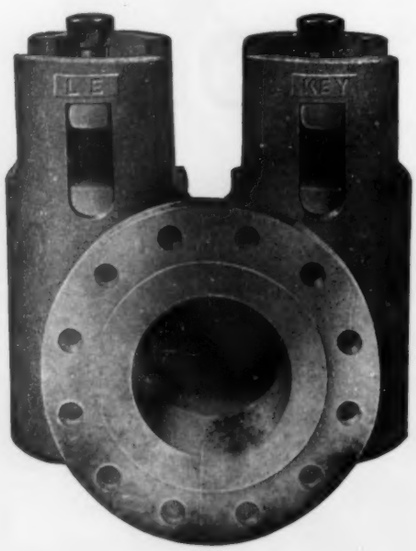
The demand for aluminum, from oil and other industries, which has risen sharply during the past decade and a half, shows no signs of leveling off. In a recent report, the President's materials policy commission suggested that aluminum consumption might possible quintuple during the next quarter century. Production facilities like the La Quinta and San Patricio plants go a long way toward meeting this rising demand.

Financial Review

The 1954 edition of The Oil Record, compiled under the direction of Henry Ozanne for Petroleum Industry Projects, contains financial data for 150 oil companies in the United States and Canada. Special tables rank a group of 54 companies in order of earnings, crude production, wells drilled, refinery crude runs and domestic reserves, mileage, barrels transported and investment in major pipe lines.

The 400-page book is available through the book department of WORLD PETROLEUM at $8 per copy.

FOR OIL REFINERY & CHEMICAL PLANTS



Two-hole Terminal Fitting with Flanged Side Outlet

FITTINGS AS SUPPLIED TO THE CORYTON REFINERY

Lake & Elliot Ltd.
BRAINTREE ENGLAND

MILLENNIUM KEY

Millennium—Key Cast Steel Fittings

FOR STRENGTH & PRESSURE TIGHTNESS

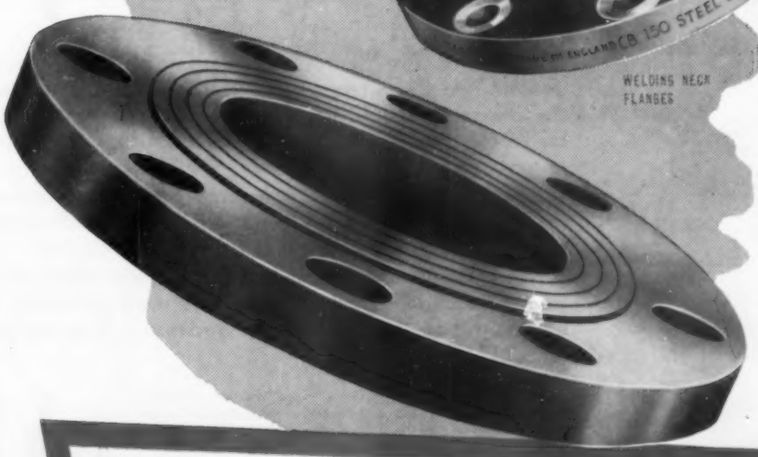
These four bulletins give full technical information on each type of fitting we can supply. Please write for them

Burton Delingpole Flanges

SLIP ON FLANGES

SEEN AROUND RIGS ALL OVER THE WORLD

WELDING NECK FLANGES



ARABIA

TEXAS

MEXICO

CANADA

IRAN

SOLID FORGED WELDLESS STEEL

HIGH PRESSURE FLANGES

BURTON DELINGPOLE & CO. LTD., OLD HILL, STAFFS, ENGLAND

London Office: Whitt & Chambers Ltd., 6 Lygon Place, S.W.1

Telephone: SLOane 7294/5

BENTONITES ACTIVATED EARTHS

CLARSOL
CLARSIL

ACTIVATED CARBON, SILICA GEL
DECOLOURISING AGENTS, FILTER AIDS
ION EXCHANGERS, ACTIVATED DOLOMITE
BENTONITES, PINE TARS
INSULATING MATERIALS, KIESELGUHRS

CECA

THE BRITISH CECA COMPANY LTD
175 PICCADILLY · LONDON · W.1

RECOVERY OF SOLVENTS, BENZOLE RECOVERY
AIR CONDITIONING, GAS DRYING
ELECTROSTATIC PRECIPITATION, DETARRING
ELECTROSTATIC SPRAY COATING
GENERAL TREATMENT OF WATER

Telephone: HYDe Park 5131 (5 lines) Telegrams: Acticarbon, Piccy, London

ONE OF THE CECA GROUP OF COMPANIES

Descale WITHOUT Danger

The Air Motor "Skatoskalo" Set enables the operators to descale and clean tubes (from ⅜" internal dia. upwards) in the shortest possible time with the greatest efficiency. The air motor gives more horse-power and does not stall when heavy deposit is encountered.

The Air Motor Driven Set incorporates all the advantages of a Rotary Air Tool without sacrificing the advantages of the electrically-driven Flexible Drive type.

"Skatoskalo" equipment can be used with complete safety and is recommended for the efficient maintenance of cracking plant, boilers, evaporators, condensers, heat exchangers, etc.

The wide range of "Skatoskalo" wire brushes, grinding wheels, small tools and accessories enables the Set to be quickly and inexpensively equipped for general purpose work.

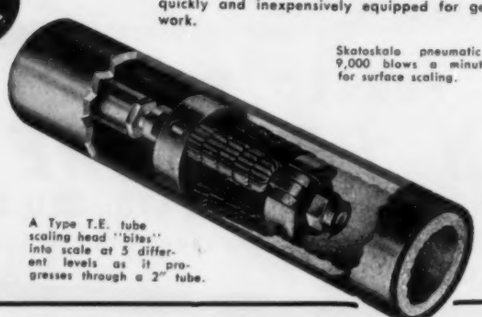
Skatoskalo pneumatic tools deliver 9,000 blows a minute. Other types for surface scaling.

The "SKATOSKALO" Single Speed Air-Driven Descaling Machine.

Flexible Drives (Gilmans) LTD.

INCORPORATING P. GILMAN (B.S.T.) LTD.

Representatives in all parts of the United Kingdom. Principal agents in over sixty countries throughout the world.



A Type T.E. tube scaling head "bites" into scale at 5 different levels as it progresses through a 2" tube.

SKATOSKALO

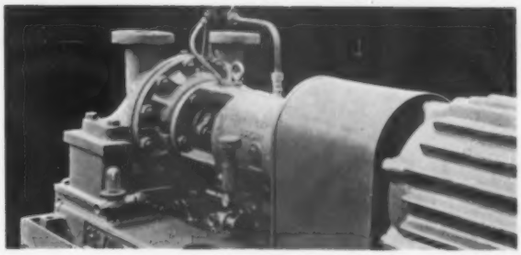
Write for Catalogue WP or contact our nearest Agent.

195 HIGH STREET, SMETHWICK 41, STAFFORDSHIRE, ENGLAND

Cables: Skatoskalo, Birmingham
Code: Bentleys

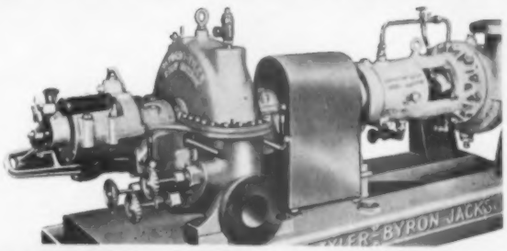
HAYWARD TYLER

BYRON JACKSON



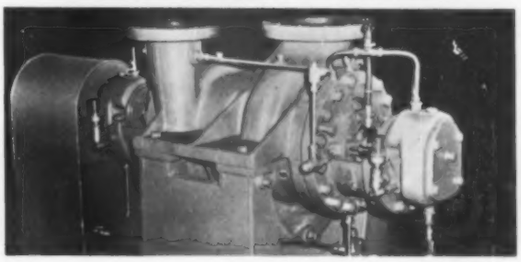
TYPE SM PROCESS PUMPS

Single and Two-stage, for quantities up to 1,100 I.G.P.M., differential heads up to 1,000 ft., and temperatures up to 800°F.



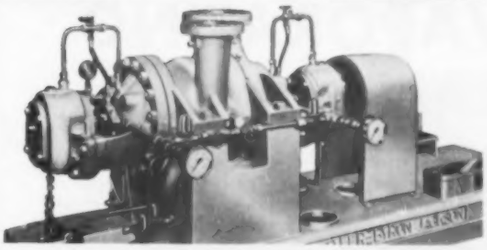
HAYWARD TYLER-TERRY TURBINES

Back Pressure Steam Turbines serving as pressure reducing valves and as prime movers for pumps, fans, generators, etc. Range: 5 to 200 H.P. at 4500 (max) R.P.M.



TYPE DSHO REFINERY PUMPS

Double Suction Hot Oil pumps with low inlet velocities ensuring maximum freedom from cavitation. For quantities up to 3,000 I.G.P.M., differential heads up to 1,400 ft., and temperatures up to 900°F.



TYPE VC REFINERY PUMPS

Two-stage pumps with vertically cut casings, for quantities up to 5,000 I.G.P.M., differential heads up to 1,500 ft., and temperatures up to 900°F.

TYPE VMT AND VHT PUMPS

Multistage pumps, with underground suction casings, giving excellent performance when handling hot or cold liquids with a low nett positive suction head. For quantities from 100 to 7,000 I.G.P.M. and heads up to 1,800 feet.

HAYWARD TYLER & CO. LTD., LUTON, BEDFORDSHIRE. TELEPHONE LUTON 3951
LONDON OFFICE 20, GROSVENOR PLACE S.W.1 TELEPHONE SLOANE 7552

G. M. COOK has been appointed assistant to the president of Oronite Chemical Co., Standard Oil Company of California marketing subsidiary. He will serve as secretary of the company's operative committee and chairman of its product quality sub-committee. He formerly was senior research chemist with California Research Corp.

R. W. Sole

MICHAEL C. MURPHY, manager of the aviation department of The Ohio Oil Co., was presented with the Honor Award of the Civil Aeronautics Administration "in recognition of his solid contribution to aviation" at a recent ceremony at Findlay, Ohio. The presentation was made by Frederick B. Lee of Washington, D.C., administrator of the CAA.

D. RAY LANGFORD has been appointed assistant division purchasing agent for Sun Oil Company's southwest division and will assist the purchasing agent, H. R. Adair, in directing the purchasing operations of Sun's widespread southwest division.

Mr. Langford received his bachelor of business administration degree from North Texas State College, Denton, in January 1944. During World War II, he served in the U. S. Navy's amphibious forces, and was in the Pacific theater for a year. He joined Sun in 1946 as field clerk-warehouseman at Sun Field, Starr County, Texas, and was warehouse supervisor at the time of his move to the purchasing department in Dallas. Mr. Langford has been a buyer for the company since May 1949. He is a member of the Purchasing Agents Association of Dallas and has served as head of a number of its committees.

R. W. SOLE has been appointed general superintendent of the production division of Arkansas Fuel Oil Corp. In his new position Mr. Sole will handle all drilling, production and similar field operations of the company. C. W. Hughes is manager of the production division.

Mr. Sole has been a member of the Arkansas Fuel Oil organization since 1920, when he became district superintendent in Newark, Ohio. He later served in various capacities in the production division in Wyoming and Texas.

In 1949 Mr. Sole was appointed assistant superintendent of the AFO production division. He held that position until his present appointment as general superintendent.

HAPPEL LOVE has been appointed superintendent of General Petroleum Corporation's Torrance, Calif. refinery. Mr. Love joined General Petroleum in 1922 as a fitter helper. He served as a stillman and shift foreman at the Torrance refinery. In 1951 he became a shift superintendent. He served in the U. S. Marines during World War I.

Broad Expansion Under Way in Latin American Refinery

(Continued from page 103)

is financed by New England, New York and Puerto Rican capital and the engineering and construction is in charge of The Lummus Co. of New York. The plant is designed for a charge capacity of 25,000 barrels daily of Venezuelan crude. It will be equipped with a two-stage distillation unit, Houdry catalytic cracker, Houdriformer, vapor recovery, polymerization and alkylation units. Completion is set for late 1955.

Products of the refinery, which represents an investment of $24,500,000, will be aviation and motor gasoline, LPGas, kerosine, diesel oil and fuel oil.

Andrew F. Carter is chairman of Commonwealth and Charles W. Saacke president. Mr. Carter, who is credited with principal activity in the formation of the company, was formerly associated with Shell Oil Co. and is a retired Rear Admiral of the U. S. Navy. Mr. Saacke is a former executive of Davison Chemical Co. Associated with them are Fred Gilbert and Edward Carey of the New England Petroleum Co., which will handle some of the products of the refinery.

WILLIAM P. HEUSER, manager of the boiler division, Henry Vogt Machine Co., was elected president of the American Boiler Manufacturers Association and affiliated industries at its recent annual meeting held at Hot Springs, Virginia. Mr. Heuser served as vice-president of the association during the 1953-1954 term.

ROBERT B. STOKKE has been elected treasurer of Esso Export Corp. He is a director and was formerly an assistant treasurer. The company appointed Norman T. Saltnes, the company's foreign exchange manager, and Allan C. Hamilton, European financial advisor, as assistant treasurers.

WEIR

EVAPORATING PLANT

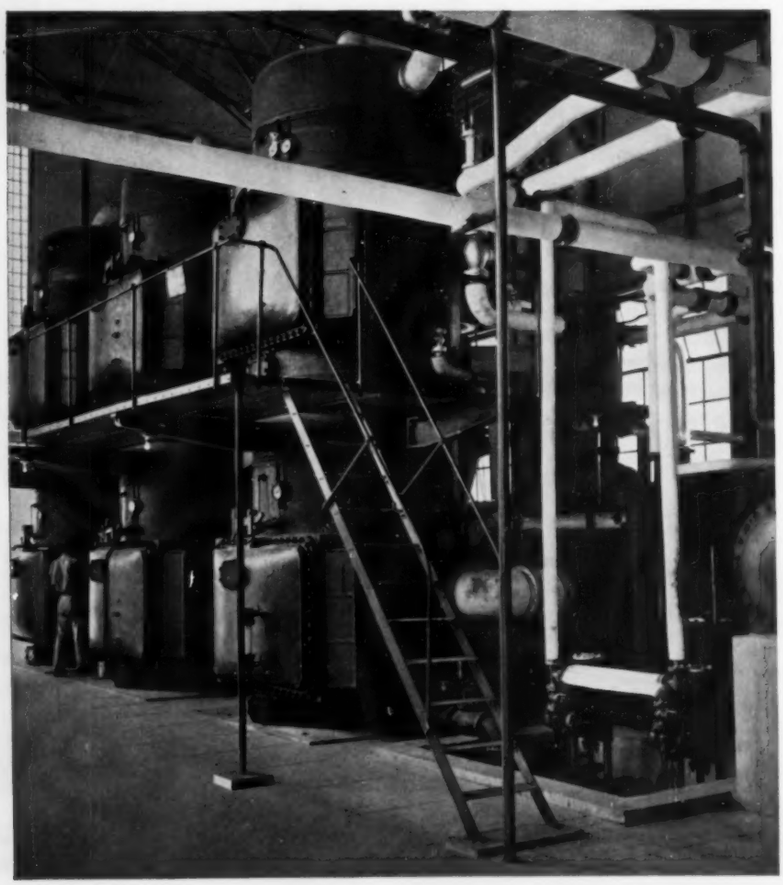
Weir Evaporating and Distilling Plant, by providing ample supplies of fresh water distilled from sea water, has made possible the economic development of many areas with no natural supply of fresh water.

Ships too, with Weir Evaporators, can make the longest voyages without buying fresh water en route, leaving more room for paying cargo, and always being sure of pure fresh water for all the ship's services.

We shall be glad to submit estimates for Evaporating and Distilling Plants on receipt of specific information as to duties.

G. & J. WEIR LTD
CATHCART GLASGOW

The illustration shows a sextuple effect plant which is producing 300 tons of fresh water daily from sea water.



* *One-hundred-and-fifty-ton per day anhydrous ammonia plant for Shell Chemical Corporation at Ventura, California.*

...and the improved economics of this new design suited National Distillers, too!

The economic highlights of Shell Chemical's new ammonia plant are impressive. Here's a brief summary:

(1) Compressor savings of between 25 and 35%.

(2) Production exceeding design guarantees.

(3) Greatly improved catalyst.

(4) Substantial reduction in cost of recovery and re-circulation facilities.

Engineering such as this interested National Distillers Products Corporation, too. And now a somewhat similar Kellogg-designed plant is going up at Tuscola, Ill., as part of its vast new petrochemical complex at this location.

The improved economics of the Kellogg ammonia process are further proof of the contribution that advanced engineering can make *today* for tomorrow's better processes. Cooperating closely with Shell's own engineering staff, Kellogg engineers, not only designed an improved converter for the nitrogen-hydrogen reaction, but also devised a new, high-pressure reforming step that conserved the pressure at which natural gas is produced.

The plant is typical of the results of Kellogg's "Engineering for Tomorrow" which finds new ways to higher yields, bigger profits, less down-time.

For detailed information on Kellogg's ammonia process write: PROCESS ENGINEERING DEPT., The M. W. Kellogg Company, (a subsidiary of Pullman Incorporated), 225 Broadway, New York 7, New York.

Other Typical Kellogg Plant Contracts Are in the Fields of: alkylation • ammonium nitrate • ammonium sulfate • catalytic reforming • combination refining • ethylene • fluid catalytic cracking • glyceride purification • liquid fuels and chemicals synthesized from coal • methanol • nitric acid • phenol-from-cumene • phthalic anhydride • polyethylene.

KELLOGG

ETHYLENE PROPYLENE BUTYLENE

KELLOGG

METHANOL ETHANOL PROPANOL

KELLOGG

BUTANOL ISO OCTYL ALCOHOL

KELLOGG

BENZENE XYLENE TOLUENE

KELLOGG

PHENOL FROM CUMENE

KELLOGG

AMMONIA UREA

KELLOGG

GLYCERIDES

KELLOGG

E. W. Dissler *Z. E. Stucky*

L. R. GOLDSMITH has been promoted to manager of manufacturing for Shell Oil Co. effective July 1, it has been announced by F. S. Clulow, manufacturing vice president. He succeeds A. H. Calderwood, who leaves shortly on an assignment abroad and retires at the end of the year.

J. R. Marsland, assistant manager of the technological department, succeeds Mr. Goldsmith as manager of that department.

Mr. Goldsmith joined Shell in 1932 at Martinez, Calif., and later held various technical and operating positions on the West Coast. During World War II he served for two years in the Petroleum Administration for War at Washington. In 1946 he became superintendent of the refinery at Wilmington, Calif. and in 1949 he was appointed to the staff of the economic development department in New York. He became manager of the technological department in 1951.

Mr. Marsland joined Shell in 1933 at Martinez and also served at San Francisco before becoming chief technologist at Wilmington in 1945. He was transferred to New York in 1948 as senior technologist and was appointed assistant manager of the technological department in 1949.

E. W. DISSLER, who has been manager of exploration for Canada-Cities Service Petroleum Corp. at Calgary, Canada, is being transferred to Bartlesville as assistant chief geologist for Cities Service Oil Co. Z. E. Stucky of Bartlesville, who has been assistant to the chief geologist, is being transferred to Calgary as manager of exploration for the Canada-Cities Service company.

Mr. Dissler has been with Cities Service since 1940 and was marine geophysicist at Houston before his appointment as exploration manager for Canada-Cities Service. Mr. Stucky joined Cities Service in 1928 and was division geologist until last year, when he was named assistant to the chief geologist.

HOWARD M. HERRON has retired as chairman of the executive committee of the Caltex group of companies after 44 years of service, it is announced by the California Texas Co. Ltd.

Mr. Herron was chosen the first president of the Caltex group when the organization was formed in 1936. In February 1946, he became chairman of the Caltex group, and in January 1950 he was appointed chairman of the executive committee. During World War II, Mr. Herron was vice chairman of the Foreign Operations Committee, Petroleum Administration for Defense.

Mr. Herron began his career in the petroleum business at the turn of the century, working in the oil fields of Oklahoma as a tank builder for the Prairie Oil and Gas Co. In 1910 he joined The Texas Co. as a stenographer in the refinery at Port Arthur, Texas, and in 1916 was promoted to superintendent at Port Arthur.

By 1928 Mr. Herron was assistant manager of The Texas Company's export department, and in this capacity visited the company's facilities in Europe, South Africa, Australia, New Zealand, China and the Philippines. In 1935, he became general manager of the export department, and in July of the following year, when the Caltex Group was formed, he moved to the new organization as its first president.

WILLIAM T. CRAVENS has been elected vice president and director of Cities Service Oil Co. (Del.) and manager of the refining division to succeed Lee N. Haugen who has been elected vice president and general manager of the Cit-Con Oil Corp. at Lake Charles, La. Mr. Cravens has been general superintendent of the refining division of the company. He has been with the Cities Service organization since 1937, when he was employed as refinery engineer. In 1942 he became chief process engineer for Cities Service Refining Corp. in Lake Charles and in 1947 went to New York City as chief process engineer for Cities Service. In 1949 he was named assistant general superintendent of the refining division of Cities Service Oil Co. and became general superintendent in 1950.

W. T. Cravens

TOUGH AS CORNISH GRANITE

In its time, the old engine-house at Carn Brea lowered many generations of miners deep down into the granite to dig for tin. Now it is only a picturesque ruin.
But not far away the firm that made tools for the same nineteenth-century miners is very much alive. Climax drills, compressors and pneumatic equipment now go all over the world. Tough as granite and as rugged as the ancient Cornish miners, they are famous for hard work and one hundred per cent reliability in the very worst conditions.

CLIMAX

PETROL, DIESEL AND ELECTRIC DRIVEN AIR COMPRESSORS, ELECTRIC & PNEUMATIC TOOLS AND EQUIPMENT

Agents in 38 countries

THE CLIMAX ROCK DRILL AND ENGINEERING WORKS LTD.

4, Broad Street Place, London, E.C.2. Works: Carn Brea, Redruth, Cornwall

TAB/CX.570.

PRESSURE VESSELS

Specialists in **CAST**

UP TO 10 TONS EACH IN WEIGHT

FOR THE CHEMICAL AND OIL INDUSTRIES

in

MANGANESE BRONZE
ALUMINUM BRONZE
PHOSPHOR BRONZE
GUNMETAL
GREY & ALLOY CAST IRON

ALL TO BRITISH OR AMERICAN SPECIFICATIONS

2 TONS EACH IN MANGANESE BRONZE BY PERMISSION OF ONE OF OUR CUSTOMERS

PHONE STOKE-ON-TRENT 87303/4

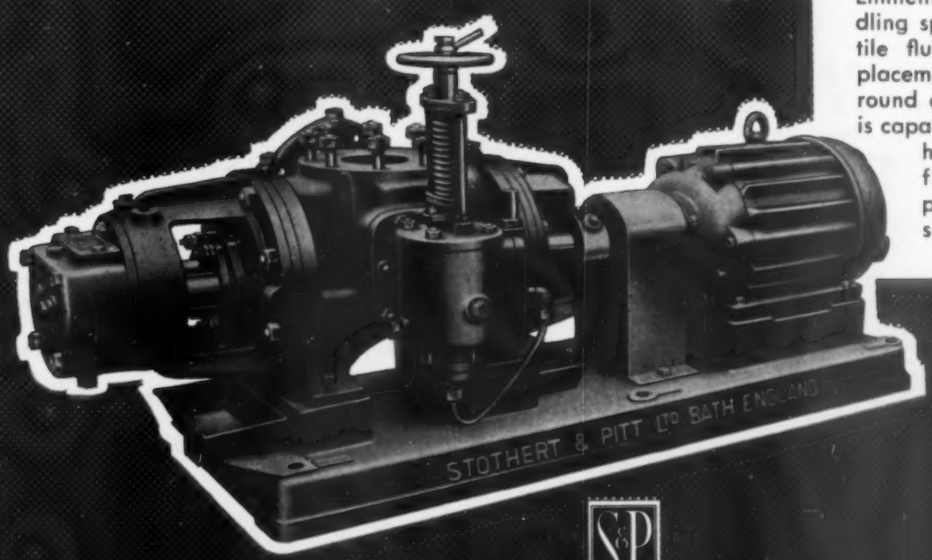
BILLINGTON & NEWTON LTD.

LONGPORT • STOKE-ON-TRENT • ENGLAND

GRAMS BRONZE LONGPORT

Aviation Spirit Pump

Eminently suitable for handling spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.



S&P LIMITED

STOTHERT & PITT LTD BATH ENGLAND

Shell Chemical Appointments

R. K. Walters, construction superintendent at the Shell Chemical Corporation's plant being erected at Norco, La., became assistant manager of the manufacturing engineering department at the head office in New York effective July 1.

C. P. Boutte, chief engineer at the company's ammonia plant in Ventura, Calif., became chief engineer at Norco on June 1. G. A. Daniels, senior engineer at Ventura, became chief engineer there.

Mr. Boutte will serve as construction superintendent during the current construction on the Norco plant, which is expected to be completed in early 1955. The multi-million dollar plant will produce alkyl chloride and chlorohydrins, serving to increase Shell Chemical's glycerine production by more than 25 million pounds per year and to make available substantial quantities of epichlorohydrin and Epon resins.

New Ammonia Plant

Mississippi River Fuel Corp. will build a $15 million ammonia plant on a 4,700-acre site near Crystal City, Missouri, 35 miles south of St. Louis. The Fluor Corp. is contractor. The company expects to be supplying anhydrous ammonia, ammonium nitrate and ammonium solutions to the fertilizer industry and certain industrial accounts by early 1956. Initial capacity of the plant will be approximately 140,000 tons per year of the three basic nitrogen products.

Maintenance Cleaning Guide

How-to-do-it charts based on actual in-plant maintenance procedures are a feature of the new "Plant Maintenance Cleaning Guide" recently published by Oakite Products, Inc., 137 Rector Street, New York 6, N.Y.

R. C. Allan *N. B. Biggerstaff*

National Export Appointments

R. Carson Allan, division engineer for the port division of The National Supply Co., has been appointed manager of the company's operations in Western Venezuela, with offices at Maracaibo, Venezuela.

Neil B. Biggerstaff, sales engineer attached to the company's general offices in Pittsburgh, has been transferred to the export division headquarters in New York City, to succeed Mr. Allan.

New Standard of Indiana Department

Effective January 1, 1955, Standard Oil Co. (Ind.) will organize a transportation and supply department which will combine under a general manager the operations of the present purchasing, traffic, and distribution economics departments. It will also take over products pipe lines, the marine and distribution terminal operations which are now handled by manufacturing, sales or production departments.

General manager will be Robert C. Gunness, now assistant general manager, manufacturing, and director. Dr. Gunness will report to F. O. Prior, executive vice president. Dr. Gunness will begin planning his new work in the final quarter of 1954.

Anti-Pollution Award

An award of merit for effectively combating industrial waste pollution was presented June 19 to the Trenton refinery of Socony-Vacuum Oil Co., Inc., by the Michigan United Conservation Clubs, a civic group consisting of 285 affiliated conservation and sportsmen's clubs throughout the state. It was the second award of its kind which has been made to industry by the United Conservation Clubs in 17 years. The award was accepted for Socony-Vacuum by Donald E. Powell, chief process engineer of the Trenton refinery, and Alfred Doty, an employee of the refinery who is past president of the Trenton Sportsmen's Club.

Halliburton Observes 30th Anniversary

The 30th anniversary of Halliburton Oil Well Cementing Co. was observed July 1 at the company's Duncan, Okla. headquarters. Fifteen men received specially engraved 30-year watches from Earle P. Halliburton, founder and chairman of the company. Some 7,500 home office employees and their families attended the company-sponsored barbecue and circus. That day was also the annual stockholders' meeting.

The Halliburton company was incorporated on July 1, 1924 with 56 employees. Today, over 700 men and women are employed in 23 states and 13 foreign countries.

New Sand Filter

The Sure Flow, a new sand filter, has been developed by the Production Specialties Company, Dallas, for use on wells where slotted pipe or screens have proven ineffective.

The filter unit employed is not damaged by acids and can safely withstand temperatures up to 1,200°F. It will handle liquid volumes up to 2,000 b/d.

OIL PIPE LINE PUMPS

HIGH EFFICIENCY ROBUST CONSTRUCTION
RELIABLE IN OPERATION

STANDARD RANGE OF PUMPS WITH CAPACITIES
UP TO 30,000 BARRELS PER DAY

DISCHARGE PRESSURES UP TO 1250 LB/SQ. IN.

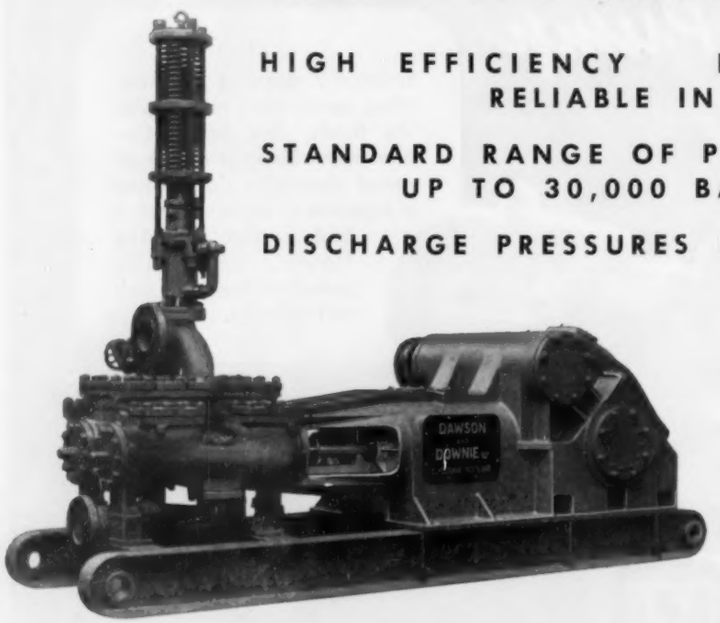
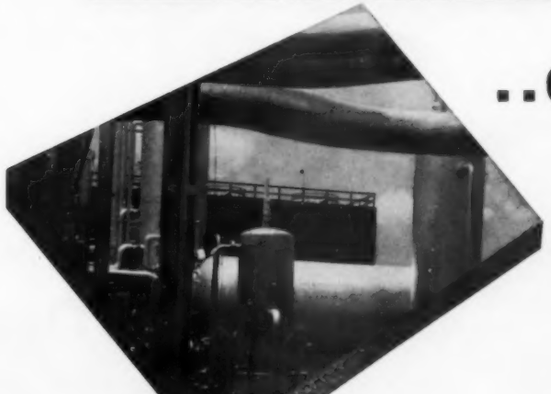


Illustration shows one of a series of pumps supplied to ANGLO-IRANIAN OIL CO's refinery at ADEN, for pumping diesel and fuel oils from the refinery to the B.P. bunkering installation.

DAWSON & DOWNIE LTD

Elgin Works, CLYDEBANK
SCOTLAND

Telegrams: Pumps, Clydebank. Telephone: Clydebank 2271/2/3



..only part of the picture

OIL REFINERY ENGINEERS know that Newalls bring more than materials to the site, because they realise that even first class insulation materials cannot do justice to themselves unless they are efficiently applied. In fact, the task of planning that the right materials are used is a job studied carefully by Newalls before their recommendations are submitted. Through consultation with Newalls you can make very certain that method as well as materials is brought to bear on the problem. That's maybe why Newalls record of refinery insulation jobs makes such an impressive picture.

RECENT CONTRACTS Among the large petroleum projects to which Newalls have supplied insulation materials recently are the Anglo Iranian Oil Company's new refineries at Aden and Kwinana and also the new Brazilian State Refinery at Cubatao, Brazil.

Where there's a HEAT INSULATION problem there's a job for **Newalls**

NEWALLS INSULATION CO. LTD. *Head Office:* Washington, Co. Durham, England. *A member of the* TURNER & NEWALL ORGANISATION
Offices and Depots at LONDON, GLASGOW, MANCHESTER, NEWCASTLE UPON TYNE, BIRMINGHAM, BELFAST, BRISTOL & CARDIFF *Agents and Vendors in most markets abroad*

BROTHERHOOD
STEAM TURBINES

For Driving Pumps, etc.

Wide range — All types.
Over 40 years' experience.
Hundreds in hand — thousands in service.

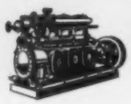
BROTHERHOOD
COMPRESSORS

Air, Gas and Refrigerating.
The widest range in the British Empire — made to suit your requirements.
Thousands in service.

BROTHERHOOD
GENERATING SETS

Turbine driven up to 11,000 KW.
Engine driven up to 340 KW.
Hundreds in hand.

BROTHERHOOD
REFRIGERATING PLANT

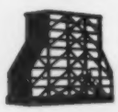


Ammonia, CO_2, Freon, Methyl Chloride, SO_2. Wide range — single and double acting — one or more stages.

BROTHERHOOD
STEAM ENGINES

High Speed Vertical
up to 500 B.H.P.
Over one hundred in hand.

BROTHERHOOD
COOLING TOWERS

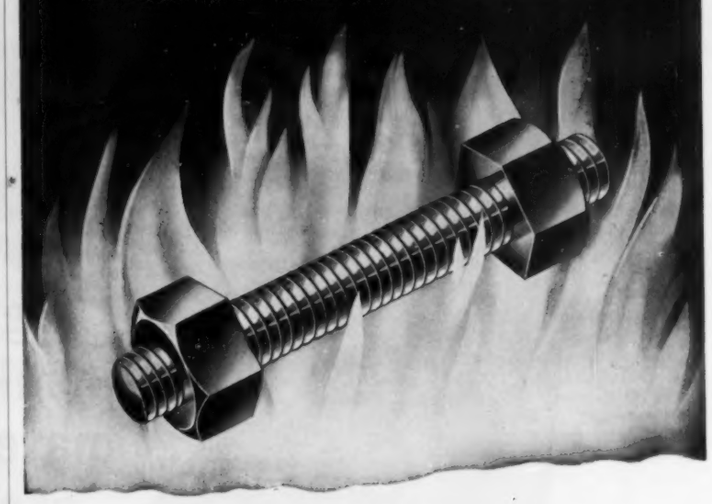


All types.
Nearly 50 years' experience.

also Manufacturers of all kinds of
PLANT TO CUSTOMERS' OWN DESIGNS
WHY NOT SEND YOUR PROBLEMS TO US?
We shall be pleased to investigate them confidentially without commitment

PETER BROTHERHOOD Ltd.
PETERBOROUGH · ENGLAND
COMPRESSOR & POWER PLANT SPECIALISTS FOR NEARLY A CENTURY

RICHARDS



SPECIAL PURPOSE

Nuts, Bolts and all-thread Studs from special creep-resisting alloy steel, supplied in fully heat-treated condition within the 55-65 ton tensile range.

Studs are B.S.970/1947 EN19A (comparable to American ASTM 193-4 (T) Class B7 and B.S.S. 1750-1951).

Nuts are Hot Forged and can be supplied to full Whitworth or American Heavy Standard sizes and heat-treated to ASTM 194-46 Class 2 or 2H and B.S.S.1750-1951.

Studs and nuts screwed to Unified, American, British Standard Whitworth Thread and British Standard Fine Thread, according to customers requirements.

CHARLES RICHARDS & SONS LTD., DARLASTON, near WEDNESBURY.

"The fruits of up to date world wide experience wedded to genuine British precision craftsmanship"

AIR CONDITIONING and REFRIGERATION

By TEMPERATURE LTD., *of* LONDON

Major contractors to various State and Governmental Departments and the Petroleum Industry in tropical areas.

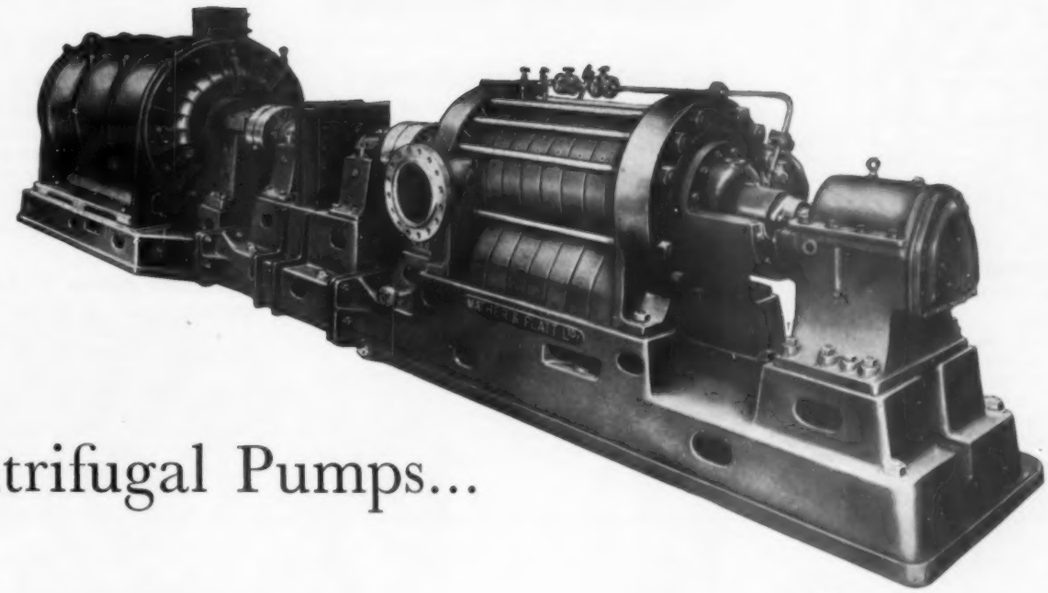
TEMPERATURE LTD.,
BURLINGTON ROAD,
FULHAM, LONDON, S.W.6

Telephones: RENown 5813 pbx

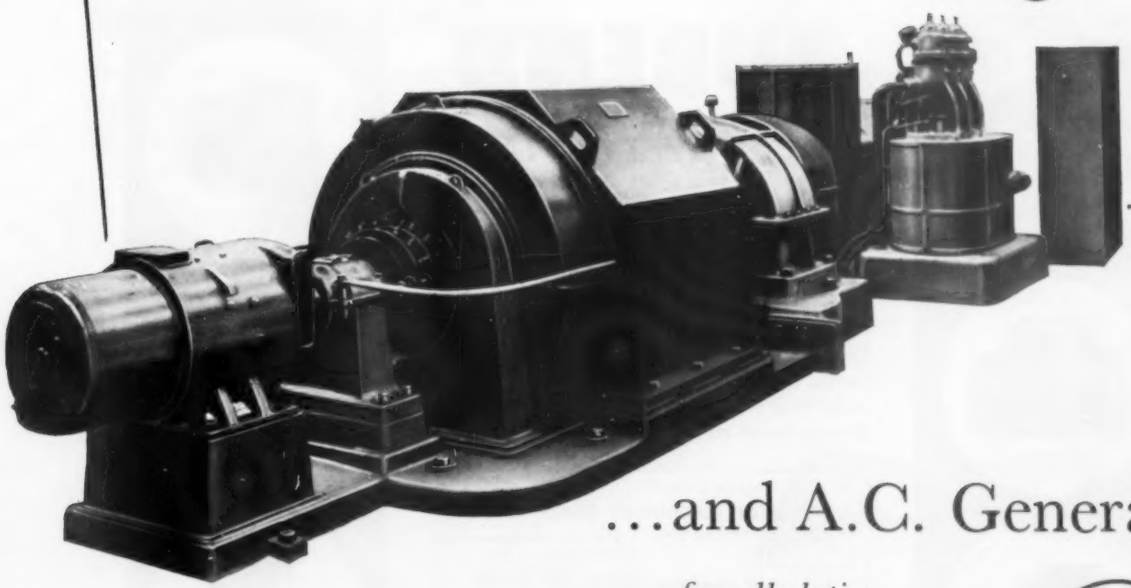
Cables: TEMTUR, LONDON

From Field to Refinery...

...Electric Motors



Centrifugal Pumps...



...and A.C. Generators

for all duties

239

MATHER & PLATT LTD Park Works Manchester 10 · Park House Gt. Smith St., London S.W.1

Beaird Names Assistant Works Manager

C. E. Russell, who has been manager of the machining division, has been promoted to assistant works manager of The J. B. Beaird Co., Shreveport, La. He will be in charge of all manufacturing departments, including machining, fabricating, stores control and maintenance. Before coming to Shreveport, Mr. Russell was assistant general manager of the Turner Brass Works in Sycamore, Ill., for three years, where he directed all production, estimating and tooling work.

Elected Chicago Corp. President

Earl B. Baldridge of Fort Worth, Texas, has been elected president of the Chicago Corp. He has been executive vice president and now succeeds Richard Wagner of Chicago, who becomes chairman of the board and chief executive officer. Two new vice presidencies have been established: Charles B. Johnson, Jr. becomes vice president in charge of production, and Ira H. Stein is made vice president in charge of leases and exploration.

Chicago Corp. recently extended its range of operations by purchasing Champlin Refining Co. of Enid, Okla. and Peppers Refining Co. of Oklahoma City. It is stated that plans are now under way for expanding the facilities of both these companies.

Advertising Agency for Axelson Lathe Division

Axelson Manufacturing Co. Division, Pressed Steel Car Co., Inc. has appointed the M. R. Crossman Co., Los Angeles agency, to handle advertising for the Axelson lathe division. This account was formerly serviced by C. B. Juneau, Inc., which will continue as advertising agency for other Axelson products, including petroleum pumping equipment, aircraft component parts and foundry.

C. E. Russell

New McCullough Sales Managers

O. J. McCullough, vice president of the McCullough Tool Co., announces the appointment of ten new district sales managers. They are: C. L. Bond, Oklahoma City; Robin Knight, Oklahoma (City Sales); C. W. Hamilton, north Texas; T. H. Farmer, west Texas; Ross Harris, south Texas; E. H. Lain, northeast Houston; W. H. Wyman, southwest Houston; Joseph Abney, southwest Arkansas, northwest Louisiana and northeast Texas; William Perkins, south Louisiana; and John W. Watson, Dallas-Fort Worth.

Mid-Continent Promotion

R. E. Elmore has been appointed assistant manager of machinery sales at the Forth Worth general offices of Mid-Continent Supply Co. Mr. Elmore has been with Mid-Continent since 1937. From 1945 until 1951 he was export manager at New York.

Wyatt Establishes Charitable Foundation

Through a donation from Wyatt Metal & Boiler Works of Houston, Texas, the W. J. Wyatt Foundation has been created for public charitable purposes. The trustees are Mrs. Annie Belle Leavell, daughter of the late W. J. Wyatt; Raleigh Hortenstine, president of the corporation, both of Dallas; George E. Gude, Jr. and Walter B. Van Wart, vice-presidents; and Guy Gambrell, secretary, all of Houston.

The indenture provides for an irrevocable trust for purposes of religious, charitable, scientific and veterans' rehabilitation service and for literary or educational activity. In setting aside $50,000 as the first fund, directors of the corporation included the anticipation that in addition to the Wyatt company, its subsidiary, Steel Tank Construction Co., and other persons, firms, corporations and associates may make contributions in the future.

McKenna Joins Hill & Christopher

Formerly advertising and sales manager for several Los Angeles industrial firms, Warren P. McKenna recently joined Hill & Christopher advertising agency in Los Angeles. During the past 15 years Mr. McKenna has had advertising and sales experience in the petroleum, chemical processing and other industries. He will serve on the plans board and as account executive for several Hill and Christopher clients.

Aerofin Moves to Larger Plant

To take care of increased heat-exchanger production, Aerofin Corp. has moved to a new plant at 101 Greenway Avenue in Syracuse, N. Y. The new plant contains 80,000 square feet of production space on one floor and occupies a 6-acre plot. The entire plant will be devoted to the manufacture of extended heat-exchange surface which Aerofin pioneered and has manufactured exclusively since 1923.

"TUBEND"

WELDING FITTINGS

The Tubend range of welding fittings meet the requirements of practically every type of prefabricated pipe assembly and the facility, economy and efficiency of fabrication becomes even more marked when working in confined spaces and effecting difficult directional changes.

The Tubend range comprises: elbows, return bends, reducers, tees and caps manufactured under strict supervision to meet the requirements of both British and American specifications.

DISTRIBUTORS IN CANADA:

VANCOUVER MACHINERY DEPOT LIMITED

Suite 1011, Royal Bank Building, 2, King Street East, TORONTO, Ontario

1155, West Sixth Avenue, VANCOUVER (9) B.C.

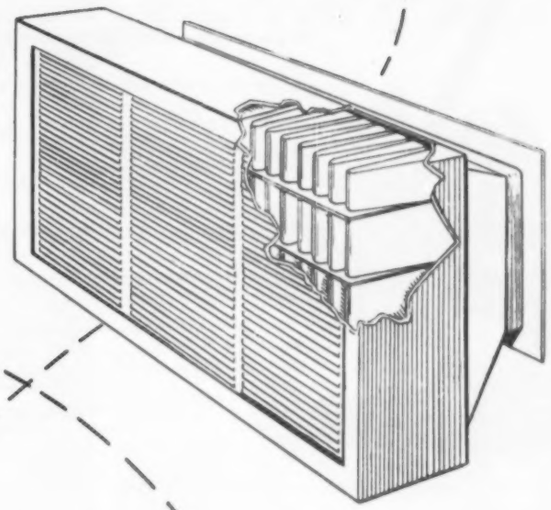
THE LUCEY CANADIAN SUPPLY CO. LIMITED
EDMONTON, ALBERTA, CANADA

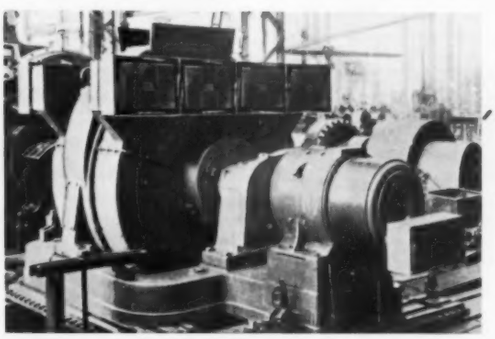
Manufacturers B·K L ALLOYS LTD·BIRMINGHAM 30·ENGLAND

VOKES FILTERS

play a vital part in keeping the oil flowing...

In the blinding desert dust storms which sweep the area of the Iraq pipelines, VOKES filters have twice been chosen for the important task of protecting pumping stations and ancillary equipment . . . proof indeed of the important part which VOKES filtration is playing throughout the world in safeguarding plant and machinery from wear, breakdown and unnecessary depreciation. Below are shown three typical aspects of VOKES protection . . . protection which cannot be jeopardized by the non-availability of element replacements because VOKES FILTERS ARE CLEANABLE.



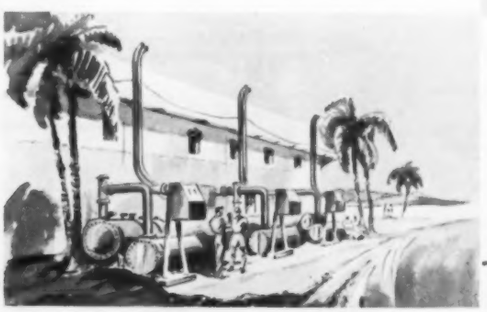


MICRO-VEE PANEL FILTERS FOR ELECTRIC MOTORS

Electric motors breathe too! . . . and these VOKES filters have proved conspicuously successful in preventing the grave damage hitherto sustained during operations in impure air conditions.

VOKES FILTERS FOR ANCILLARY EQUIPMENT

Compressors . . . portable generaters . . . welding sets . . . power packs . . . all need protection against the ingress of abrasive dust, whether by air-intake, lubricating oil or fuel.



VOKES FILTERS FOR STATIONARY DIESEL ENGINE

Under abnormal conditions like these, engines have to be doubly protected and these large diesel engines are therefore fitted with Microvee dry fabric filters for cleaning the intake air. Vokes Filters are also specified for atmospheric air filtration in the ventilating systems of many of the desert buildings.

VOKES LIMITED

VOKES LIMITED. *Head Office:* **GUILDFORD, SURREY, ENGLAND**

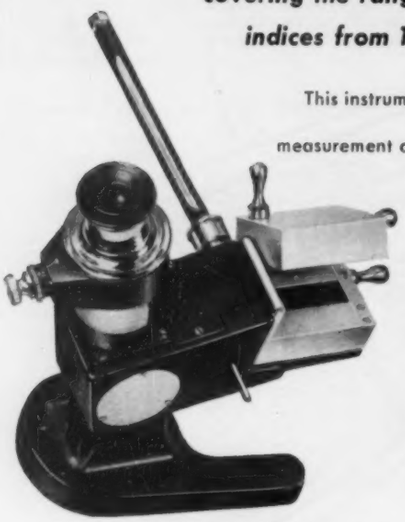
London Office: 40 Broadway, Westminster, S.W.1 • Vokes (Canada) Ltd., Toronto • Represented Throughout the World • Vokes Australia Pty. Ltd., Sydney

V116A

PRECISION BS INSTRUMENTS

Oil Refractometer

covering the range of refractive indices from 1·42 to 1·49



This instrument is widely used for the rapid measurement of oils, fats, etc., and is supplied with achromatising device for the elimination of colour on the border line, and with temperature control.

Bellingham & Stanley instruments are used in all parts of the world for testing oils, optical glass, chemicals, drugs, etc.

These instruments can be supplied direct from the makers:

Bellingham & Stanley Ltd.

DEPT. P, 71 HORNSEY RISE, LONDON N. 19, ENGLAND PHONE: ARCHWAY, 2270

or from:

C. A. Brinkmann & Company, P.O. Box 532, Great Neck, L.I., New York, U.S.A.

TROPIC CEILING FANS

fully TROPICALISED *to ensure* LONG LIFE and EFFICIENT SERVICE IN ALL HOT CLIMATES

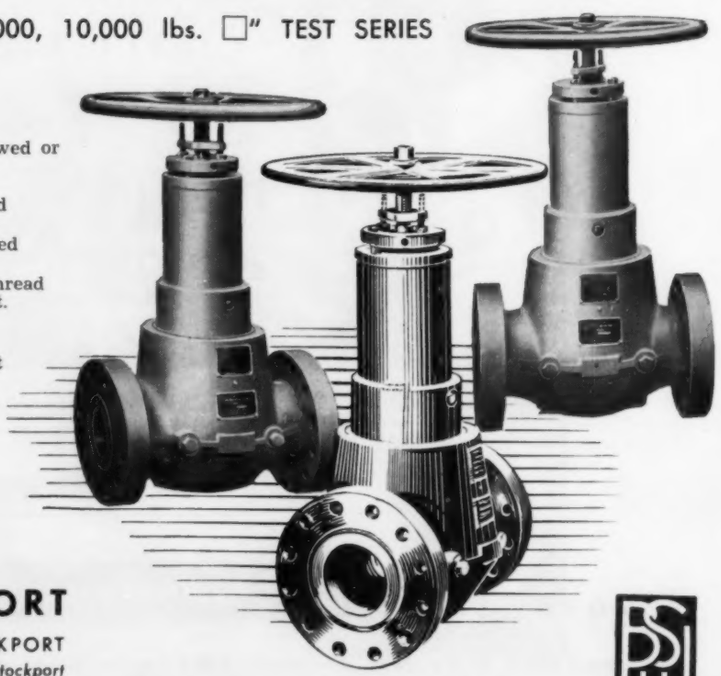
BROOKE INDUSTRIES LIMITED

KENT HOUSE, TELEGRAPH STREET, MOORGATE, LONDON, E.C.2, ENGLAND

Bolton's

FORGED STEEL PRODUCTION VALVES

4,000, 6,000, 10,000 lbs. □" TEST SERIES



VALVE BODY. Drop forged steel to A.P.I. requirements, screwed or flanged to appropriate standards.

VALVE COVER. Drop forged steel to A.P.I. requirements embodying Bolton's Patent Cone Seal Joint with square form thread eliminating bursting stresses.

WEDGE. Drop forged stainless steel having non-reversible machined integral guides and giving full cover to body seat faces.

SPINDLE. Alloy steel screwed 4 T.P.I. left hand full depth Acme thread working in Nickel Aluminium Bronze bush with ample engagement.

FRICTION RINGS. Nickel Aluminium Bronze for test pressures 4,000 lbs.□" and 6,000 lbs.□".

LABYRINTH THRUST BUSH. Nickel Aluminium Bronze for test pressure 10,000 lbs.□".

HANDWHEEL. Malleable Iron having arrow indicating anti-clockwise opening.

INDICATOR. Single Pillar type can be supplied if required with Bronze arm having self cleaning threads.

TESTS. Each valve is subject to pressure tests on wedge faces and body with water or kerosene.

Bolton's OF STOCKPORT

BOLTON'S SUPERHEATER & PIPE WORKS LTD., STOCKPORT

Telephone: Stockport 3604 (4 lines). *Telegrams: "Heatizer" Stockport*

SOLE SELLING AGENTS: **THE OIL WELL ENGINEERING CO. LTD., RIVER PLATE HOUSE, SOUTH PLACE, LONDON, E.C.2**

dm BS 47

IN THE APPLICATION OF RUBBER TO OIL PRODUCTION—

Part of the Shell refinery at Cardon in Venezuela. (*A Shell photograph*)

Service assures success—

Dunlop Oil Suction and Discharge Hose to British Standard Specification 1435 Type 3. This 8" bore hose is suitable for use at working pressures up to 200 lb./sq. in. Photograph shows the hose at one stage of the rigourous testing programme to which every length is subjected.

The Technical Advisory Service that Dunlop offers the oil industry plays a great part in *the consistent success* of Dunlop equipment in oil installations throughout the world. Experience of installations operating in every conceivable condition enables Dunlop experts to provide thoroughly practical, up-to-date guidance on new projects, extensions, replacements, repairs and development. In this way, the most efficient use is made of equipment designed for the job with characteristic Dunlop thoroughness.

The range of Dunlop products for the industry is indicated below. To take advantage of the Service offered, simply contact your nearest Dunlop distributor or representative — or write to the address below.

DUNLOP
A WORLD WIDE SERVICE TO THE OIL INDUSTRY

OIL SUCTION & DISCHARGE HOSE, SLUSH PUMP HOSE.
INDUSTRIAL HOSES for a wide range of uses in the Oil Industry such as welding, and pnuematic tool use.
V-BELTS to A.P.I. or B.S.I. Specifications.
FLAT TRANSMISSION BELTING.
VALVE INSERTS.
SWAB RUBBERS.
CEMENTING PLUGS.
PACK-OFF RUBBERS.
PISTON RINGS.

DUNLOP RUBBER CO. LTD. (GENERAL RUBBER GOODS DIVISION), MANCHESTER, ENGLAND

Heads Ideco Advertising

Appointment of Richard M. Perdue as advertising manager for Ideco, a division of Dresser Equipment Co., has been announced by G. W. Walton, Ideco vice president. Ideco is one of the Dresser Industries. Advertising offices are located in the Atlantic Building, Dallas.

For the past four years Mr. Perdue was advertising and publicity manager for Browning-Ferris Machinery Co., distributors of heavy construction equipment.

New GSI Division

E. O. Vetter has been appointed assistant vice president, administration, for Geophysical Service Inc., the GSI board of directors has announced. He heads a newly-organized administrative division set up to coordinate GSI staff functions and to consolidate activities of the company's control and equipment departments.

Mr. Vetter joined the staff of GSI as controller in 1952. He holds a B.S. degree in mechanical engineering from the Massachusetts Institute of Technology and is a member of the Society for the Advancement of Management, the American Petroleum Institute and the Dallas chapter of the Society of Exploration Geophysicists.

Names New Construction Manager

E. J. Ford has been named a construction manager of Stone & Webster Engineering Corp., T. C. Williams, executive vice president, has announced. Mr. Ford will have offiices at company headquarters in Boston. He has been 31 years with Stone & Webster, working on projects all over the U. S. and abroad. Mr. Ford has been general superintendent for the last six years of Stone & Webster projects for the Gulf States Utilities Co., Beaumont, Texas.

R. M. Perdue

Andreas Named to Westinghouse Post

Charles A. Andreas has been named regional supervisor for the Middle East area of the Westinghouse Electrical International Co., New York, N. Y. Mr. Andreas will be stationed in Beirut, Lebanon and will assist Westinghouse distributors in that area on all types of products. An expert on commercial refrigeration and air conditioning, he will give special attention to products in those fields.

Mr. Andreas joined Westinghouse in 1944 as an application engineer. He became supervisor of commercial refrigeration for the International company in 1948 and since then has visited the company's distributors in Greece, Turkey and Cyprus.

Isopthalic Plant

Standard Oil Co. of California has begun the erection of a new petrochemical unit at its Richmond refinery to product isopthalic, a new raw material for the plastics industry. Previously only experimental quantities have been produced. The new plant will be completed in 1955 and will produce 50 million pounds per year. Metaxylene from Standard's catalytic reforming plant will be used as raw material. Tests of isopthalic have indicated that it is superior to pthalic anhydride for the manufacture of oil-modified alkyd resins.

Davison Opens New Office in Houston

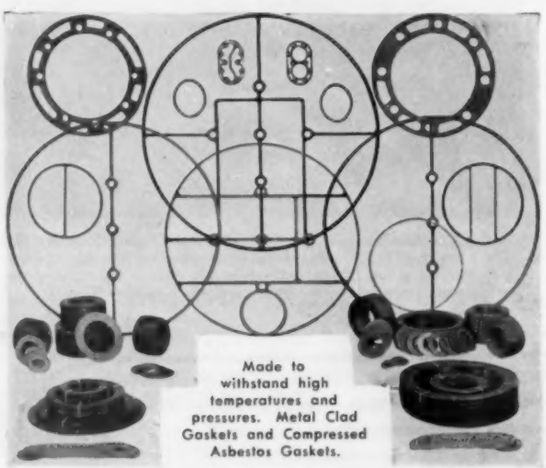
Davison Chemical Co., division of W. R. Grace & Co., has opened a new office to cover the southwest and Gulf Coast areas at 4101 San Jacinto, Houston, Tex. John Benedict, sales representative of the petroleum catalyst department, is being transferred to Houston from Baltimore to promote catalysts for refineries. C. Victor Bolles, field service engineer, industrial chemicals department, is being moved to Houston from Lake Charles, La., to handle sales in the area of silica gels, fine silicas, specialty catalysts and others in Davison's diversified line of industrial chemicals.

Tanker Visits New York

The 38,000-ton SS W. Alton Jones, flagship of the Citiees Service fleet, visited New York on her maiden voyage June 21. The 22,000 hp ship is the world's fastest supertanker. Her cost was $9.5 million. When the W. Alton Jones is joined later this year by three sister ships, the SS Statue of Liberty, the SS Liberty Bell and the SS Cradle of Liberty, the Cities Service supertanker fleet will surpass any comparable fleet anywhere. Each will have a cargo capacity of 336,000 barrels.

THE GASKET MANUFACTURING CO.

Gaskets for the Oil Industry



Made to withstand high temperatures and pressures. Metal Clad Gaskets and Compressed Asbestos Gaskets.

METAL CLAD GASKETS

made from ANY material — shaped to ANY specification and for EVERY purpose.

•

HEAT EXCHANGERS — BOILERS — PUMPS ENGINES, ETC.

THE GASKET MANUFACTURING CO.

320 VENICE BOULEVARD, LOS ANGELES 15, CALIF., U. S. A.

The quality of our M.S. fluid cracking catalyst KETJENCAT is an established success; our unique method of delivering this product by the Ketjen-Polysius tank cars is also proving highly successful.

These tank cars now operate on the European Continent and, apart from time and labour economies in discharging, this means:

- no cost of bags and consequent handling charges
- no loss of catalyst in transit
- no contamination of moving parts of refinery equipment by catalyst particles

12 TONS „KETJENCAT"

UNLOADED IN 20 MINUTES

KONINKLIJKE ZWAVELZUURFABRIEKEN v/h

KETJEN N.V.

AMSTERDAM - THE NETHERLANDS

Founded 1835

Sales office:

Nederlandsch Verkoopkantoor voor Chemische Producten N.V. - 63 Mauritskade Amsterdam-Holland

Jenkins

of ROTHERHAM

for

Fractionating column 6'-0" dia. x 65'-0" high made for Foster Wheeler Ltd. for Hess Products Ltd. : Fatty Acid Plant.

IVANHOE TRADE MARK

Welded Work

The Ivanhoe trademark identifies the craftsmanship and dependability of Jenkins-welded equipment. Pipe work, tanks, fractionating columns, condensers, pressure vessels, are typical examples of the fabricated welded work we are producing to Class I standard.

Our new catalogue "Welded Fabrications" details our organisation and facilities. May we send you a copy?

Robert Jenkins & Co. Ltd.
ESTABLISHED 1856
ROTHERHAM

ROBERT JENKINS & CO. LTD., ROTHERHAM, ENGLAND

Telephone: Rotherham 4201-6 (6 lines)

SULO

DIE QUALITÄTSMARKE SULO

DRUMS, CANS AND PAILS FOR OIL INDUSTRY TRANSPORT

EISENWERK STREUBER & LOHMANN GmbH • HERFORD, WEST GERMANY

BOOKS

PHYSICAL PRINCIPLES OF OIL PRODUCTION—Morris Muskat $15.00

PRACTICAL OIL GEOLOGY—Dorsey Hager ..... $ 8.00

PETROLEUM PRODUCTION ENGINEERING—L. C. Uren
"Oil Field Development" ..... $ 8.50

PETROLEUM PRODUCTION ENGINEERING—L. C. Uren
"Oil Field Exploitation" $10.00

PETROLEUM PRODUCTION ENGINEERING—L. C. Uren
"Petroleum Production Economics" ..... $ 8.00

PETROLEUM REFINERY ENGINEERING—N. L. Nelson $10.00

PETROLEUM PRODUCTION (5 Volumes)—Park J. Jones
Vol. 1—Mechanics of Production: Oil, Condensate and Natural Gas, 1946 ..... $ 5.00
Vol. V—Oil Production by Gas & Flooding, 1948 ..... $ 6.00

PRINCIPLES OF PETROLEUM GEOLOGY—Wm. L. Russell ..... $ 7.50

PRINCIPLES OF SEDIMENTATION—2nd Edition—W. H. Twenhofel ..... $ 7.70

ROTARY DRILLING HANDBOOK—5th Edition—Brantly $10.00

SAFETY IN PETROLEUM REFINING & RELATED INDUSTRIES—
George Armistead, Jr. $10.00

THE SCIENCE OF PETROLEUM, Vol. 5, Pt. 1,
Crude Oils—Benjamin T. Brooks and A. E. Dunston $11.00

THEORY AND PRACTICE OF INDUSTRIAL RESEARCH—
David Bendel Hertz ..... $ 5.50

WORLD GEOGRAPHY OF PETROLEUM—edited by Wallace E. Pratt and Dorothy Good ..... $ 9.20

TO ORDER, WRITE TO:

BOOK DEPT. WORLD PETROLEUM

604 FIFTH AVE., NEW YORK 20, N. Y.

The Greater the Need for .....

Illustration shows Meadows 6GJ630 natural gas engine in self contained power plant. Developing 96 B.H.P. at 1600 R.P.M., this power plant is suitable for direct-coupled or belt driven equipment. Similar units are offered for operating on diesel fuel or gasoline.

Reliable Power

Meadows have a lifetime of experience behind them in providing reliable and economic power in far away places and under the most arduous conditions. As prime movers for oilfield equipment Meadows engines have been proved.

Manufacturers of natural gas, gasoline and diesel engines ranging from 30—300 B.H.P.

HENRY · MEADOWS · LIMITED

FALLINGS PARK · WOLVERHAMPTON · ENGLAND

Telephone: Wolverhampton 31921 Telegrams and Cables: OUTPUT, Wolverhampton

An Associated British Engineering Company

Brazilian Refinery Contract Let

Southwestern Engineering Company, Los Angeles, has been awarded a $4 million contract for the erection of a complete petroleum refinery for Companhia de Petroleo da Amazonia at Manaus, Brazil. Charge capacity is to be 5,000 b/d. Universal Oil Products fluid catalytic cracker, treating and blending facilities, drum and can filling plant, utilities, tank farm and loading dock will be built.

Located in northern Brazil, some 900 miles up river from the mouth of the Amazon, the new refinery will be the sole producer of refined petroleum products in the entire Brazilian Amazon valley. It is anticipated that a portion of the refinery's output will be consumed in the middle and upper valley, with the remainder being barged down-river for consumption in Para or trans-shipped to the states of Maranhao and Ceara.

Texas Company to Build Alkylation Unit

Catalytic Construction Company of Philadelphia has announced that it has received a contract to erect an alkylation unit at The Texas Company's Eagle Point Works at Westville, New Jersey. The unit, which uses sulfuric acid as a catalyst, is designed to produce 1,926 barrels of alkylate per operating day to be used in the manufacture of aviation gasoline.

Suggests Chihuahua Wildcatting

Wildcatting in the northwest of the State of Chihuahua, the north of Sonora and in a belt stretching from the Yucatan salt basin south to Guatemala and west to Tabasco has been suggested by Guillermo P. Salas, consulting geologist of Petroleos Mexicanos and former chief geologist of the government oil agency. Sr. Salas made his proposal in an address before the National Geological Convention held recently in Mexico City.

Visits Eastern Fields

E. E. Williams, export representative for Technical Oil Tool Corp., has left on an extended trip to England, France, Italy, Germany, the Middle East, Far East and the Near East. He will render technical assistance on the Totco line, and will introduce the new Totco mechanical directional recorder.

Electric Sediment Separation

The Petreco division of Petrolite Corp. has published an illustrated booklet descriptive of the new Petreco electric sediment separator which is available without charge. The book describes the separating equipment and gives details on how it increases the life of sub-surface hydraulic pumping equipment by preventing wear and abrasion caused by inorganic solids.

D & B to Market Otis Pump

Otis Pressure Control, Inc., and D & B Division of Emsco Manufacturing Co. have concluded an agreement which authorizes D & B to manufacture, sell and service exclusively the Otis two-zone sub-surface pump. All engineering and manufacturing operations for the D & B-Otis two-zone pump have been transferred to the D & B plant in Garland, Texas.

Valve Control Bulletin

Philadelphia Gear Works has published bulletin SMA-000 to describe new SMA-00 and SMA-000 Limi-Torque valve controls for small valves ranging from 1½ to 8-inch part diameters. These new motorized valve operators may be controlled electrically from any conveniently located pushbutton station. In case of power failure, a handwheel is incorporated in the control unit for manual operation if necessary.

Railway Expenditures For Oil Products

According to a report prepared by the Association of American Railroads, the expenditures of Class 1 railways of the United States for petro-products during 1953 amounted to nearly $400 million in 1953, an increase of $21 million over the preceding year.

Railroad purchases of diesel oil alone in 1953 came to $300 million, an increase of $38 million over the preceding 12-month period, reflecting the progress being made toward complete dieselization of the country's railways which has now reached a point where diesels handle 80 percent of all railroad transportation service. It is stated that the carriers now use up to half of all the diesel oil consumed in the United States.

Spending for residual oil amounted to $45 million in 1953, while more than $10 million was spent for gasoline. The railroads paid out an additional $42 million last year for lubricating oils, greases, boiler compounds and related products.

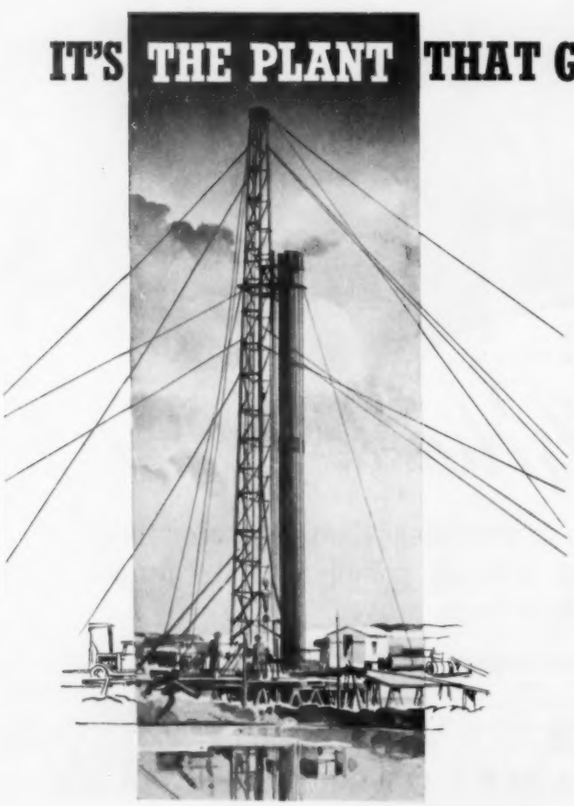
New Supply Company

The Frank Wheatley Supply Co., specializing in oil industry supplies and equipment, has recently been formed in Tulsa, it was announced by Frank Wheatley, Jr., president of the new firm. Officers include: Huber Dye, vice president and general manager; Gus Baker, vice president; and Clarence Hunter, secretary-treasurer.

Removable Collar Stop

Otis Pressure Control, Inc., has developed a removable tubing collar stop which performs all of the functions of conventional bull plugs or pin collars and can be withdrawn from the well by regular wire line methods. The stop can be set in any collar and does not require a special seating nipple or shoe.

IT'S THE PLANT THAT GETS THE OIL THAT TURNS THE WHEELS



— Be sure of your Plant

One of the great indispensables of oil-winning is Steel Wire Rope, and we manufacture it with just such tough conditions as yours in mind.

We supply to B.S.I., A.P.I., Lloyd's and all other recognised requirements, but we shall also be glad to quote to any other specifications for your special needs.

We have been making Ropes and Canvas for over 200 years now, and by giving quality and service have earned our world-wide reputation for first class products.

Our 92-page Booklet (Ref) 0.1/6. on the "Hows and Whats" of Steel Wire Rope is available **Free** on request.

IF IT'S GOUROCK IT'S GOT GUTS

Manufacturers also of Nylon, Terylene, Manila, Sisal, etc., Ropes. Sole Manufacturers of Birkmyre's Rotproofed and Waterproofed Cloth.

THE GOUROCK ROPEWORK CO., LTD.

Telephone **PORT-GLASGOW, SCOTLAND** *Telegrams*

PORT GLASGOW 41261 GOUROCK-TELEX PORT GLASGOW

ROPE CANVAS NET TENT AND COVER MANUFACTURERS

Our Canadian sister Company—Messrs. Gourock Bridport, Limited, will be pleased to help you in any way from the following addresses:—Head office—138, St. Peter Street, MONTREAL and LUNENBURG, N.S.

REFRACTORY CONCRETE
&
INSULATING CONCRETE
made with

CIMENT FONDU
Regd Trade Mark
ALUMINOUS CEMENT

Used in the construction and
maintenance of Oil Installations
throughout the World

INCLUDING THE NEW REFINERIES IN ADEN, AUSTRALIA AND IRAQ
FEATURED IN THIS ISSUE

We shall be pleased to supply on request, a number of copies of an article "High Alumina Cement in Oil Refineries" by Dr. T. D. Robson, B.Sc., Ph.D., F.R.I.C., M.Inst.F.

LAFARGE ALUMINOUS CEMENT COMPANY LIMITED
73, BROOK STREET, LONDON, ENGLAND

CIMENT FONDU LAFARGE CORPORATION
141, East 44th Street, New York 17, N.Y.

CIMENT FONDU LAFARGE (CANADA) LTD.,
1405, Peel Street, Montreal, P.Q.

® 5/1182

ADVERTISERS' INDEX

(Advertising Agencies in Italics)

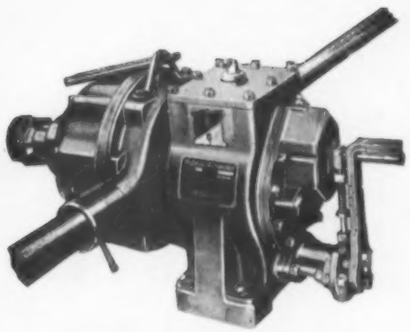
Aerofin Corporation 22
Richards & Webb, Inc.
Air Pumps Ltd. 165
Goddard Watts Ltd.
John Allen & Sons (Oxford) Ltd. 158
American Cyanamid Co., Refinery Chemicals Dept. 43
Hazard Advertising Co.
Anglo-Iranian Oil Co. Ltd. 127
S. H. Benson Ltd.
Arabian American Oil Co., Inc. 3
Audley Engineering Co. Ltd. 32
Marsteller, Gebhardt & Reed, Inc.
Babcock & Wilcox Ltd. 5
S. H. Wright & Co. Ltd.
E. B. Badger & Sons (Gt. Britain) Ltd. 16
Harold Cabot & Co., Inc.
Thames Advertising Service Ltd.
Barnes & Bell Ltd. 129
Bechtel Corporation 121
Ryder & Ingram Ltd.
Bellingham & Stanley Ltd. 186
H. A. Collins, Esq.
Billington & Newton Ltd. 179
B. K. L. Alloys Ltd. 184
Sandbrook Metcalf & Co. Ltd.
Blaw-Knox Co., Chemical Plants Division 25
Ketchum, MacLeod & Grove, Inc.
Bolton's Superheater & Pipeworks Ltd. 186
Donald MacDonald (Adv.) Ltd.
Born Engineering Co. 28
Watts, Payne-Advertising, Inc.
British Ceca Co. Ltd. 174
British Ropes Ltd. 160
D. J. Keymer & Co. Ltd.
British Thomson-Houston Co. Ltd. 135
Technical & General Adv. Ltd.
Brooke Industries Ltd. 186
Peter Brotherhood Ltd. 182
Rooster Publicity Ltd.
Brown Fintube Co. 14
Henry T. Bourne Advertising Agency
Butterley Co. Ltd. 21
Rowlinson-Broughton
California Texas Oil Co., Inc. 6
Erwin, Wasey & Co., Inc.
Cameron Iron Works, Inc. 167
Rives, Dyke and Co.
The Cape Asbestos Co. Ltd. 39
Taylor Adv. Ltd.
Chicago Bridge & Iron Co. 1
Russell T. Gray, Inc.
Christiani & Nielsen Ltd. 166
Climax Rock Drill & Engr. Co. Ltd. 178
Technical Advertising Service
Richard Costain Ltd. 141
Crane Company 24
The Buchen Company
Crane Packing Ltd. 157
Ruddock Advertising Agency
J. Ainsborough Everiss & Assoc. Ltd.
Davey Paxman & Co. Ltd. 164
Rooster Publicity Ltd.
Davison Chemical Corporation 51
St. Georges & Keyes, Inc.
Dawson & Downie Ltd. 180
Burton Delingpole & Co. Ltd. 173
S. H. Wright & Co. Ltd.
Dikkers & Co., N. V. 115
Ir. J. Bauduin
The Dredging and Construction Co. Ltd. 151
Dunlop Rubber Co. Ltd. (G. R. G. Overseas) 187
Chas. F. Higham Ltd.
E. I. du Pont de Nemours & Co. Inc. 37-38
Chas. L. Rumrill & Co., Inc.
E. C. D. Ltd. 133
Samson Clark & Co. Ltd.
Eisenwerk Streuber & Lohmann G.m.b.H. 190
Elliott Brothers (London) Ltd. (Fisher Governor Co. Ltd.) 169
R. S. Caplin Ltd.
Ernst Water Column and Gage Co. 158
Ethyl Corporation 7
Batten, Barton, Durstine & Osborn, Inc.
Flexible Drives (Gilmans) Ltd. 174
Boswell & Barratt Ltd.
Fluor Corporation 113
Dozier-Eastman & Co.
Foster Wheeler Corporation 142
Rickard & Co.
Gasket Manufacturing Co. 188
General American Transportation Corporation 36
Weiss & Geller, Inc.
General Electric International 17-20
Grant Advertising, Inc.
General Electric Company of England Ltd. 170
Kingscott Ltd.
Gourock Ropework Co. Ltd. 192
Sommerville & Milne Ltd.
Graver Tank & Manufacturing Co., Inc. 42
The Buchen Company
Grünzweig & Hartmann, A. G. 170
Gulf Oil Corporation 30
Young & Rubicam, Inc.
J. P. Hall & Sons Ltd. 166
Rooster Publicity
Halliburton Oil Well Cementing Co. 56
Hill & Christopher, Inc.
Hammel-Dahl Co. 53
Frank H. Deane Advertising
Harland & Wolff & Co. Ltd. 122
The Harshaw Chemical Co. 26
Hayward Tyler & Co. Ltd. 175
Howards Publicity
Hercules Powder Company 34
Fuller & Smith & Ross, Inc.
Hollandse Aanneming Maatskappy 156
Holman Brothers Ltd. 195
Samson Clark & Co. Ltd.
Houdry Process Corp. 106
Arndt, Preston, Chapin, Lamb & Keen, Inc.
Hudson Engineering Corporation Cover III
Brennan Advertising Agency
Hurst, Nelson & Co. Ltd. 160
Osborne-Peacock Co. Ltd.
International Paints Ltd. 163
Mayfair Advertising Ltd.
International Standard Electric Corp. 10
J. M. Mathes, Inc.
Robert Jenkins & Co. Ltd. 190
Wm. Hopwood & Co. Ltd.
K. L. Kalis Sons & Co. Ltd. 151
The M. W. Kellogg Company 177
Gordon Baird Associates
Ketjen 189
Raedt en Baet
Richard Klinger Ltd. 109
S. H. Wright & Co. Ltd.
The Kwinana Construction Group (Pty.) Ltd. 153
Stanley D. Dickson
Lafarge Aluminous Cement Co. Ltd. 193
Allardyce Palmer Ltd.
Lake & Elliot Ltd. 172
Ripley Preston & Co. Ltd.
London & Midland Steel Scaffolding Co. Ltd. 33
S. H. Wright & Co. Ltd.
The Lummus Company 54
Sterling Advertising Agency, Inc.
Arthur G. McKee & Company 111
Meermans, Inc.
Mannesmann Export G.m.b.H. 161
Mather & Platt Ltd. 183
Sydney F. Wicks Ltd.
Henry Meadows Ltd. 191
General Advertising Co. of London Ltd.
Metal Containers Ltd. 144
Murray-Watson & Co. Ltd.
Metal Textile Corporation 46
Samuel Croot Co., Inc.
Metropolitan Vickers Electrical Co. Ltd. 52
Technical & General Adv. Ltd.
Moon Brothers Ltd. 137
Donald MacDonald (Adv.) Ltd.
The Motherwell Bridge Contracting & Trading Co. 169
National Aluminate Corporation 31
Armstrong Advertising Agency
Wm. Neill & Sons (St. Helens) Ltd. 119
A. P. Newall & Co. Ltd. 4
Osborne-Peacock Co. Ltd.
Newalls Insulation Co. Ltd. 181
Doig Adv. Ltd.
Newman Hender & Co. Ltd. 44
Newton Chambers & Co. Ltd. 171
Stanley D. Dickson
Nordstrom Valve Division, Rockwell Mfg. Co. 32
Marsteller, Gebhardt & Reed, Inc.
Samuel Osborn & Co. Ltd. 150
The Ralph M. Parsons Company 27
Dozier, Eastman and Company
Peabody Engineering Corporation 149
Richard La Fond Advertising, Inc.
Petreco 123-124
John C. Fellows Company
Petro-Chem Development Co., Inc. 40-41
Sam J. Gallay Advertising
Philco Corporation (Government & Industrial Div.) 50
Julian G. Pollock Co.
Port of Bristol Authority 134
Walter Pearce & Co. Ltd.
D. & C. & Wm. Press Ltd. 139
Taylor Adv. Ltd.
Procon, Incorporated 8-9
Marsteller, Gebhardt and Reed, Inc.
Pye Telecommunications Ltd. 159
Arks Publicity Ltd.
The Pyrene Co. Ltd. 155
Nelson Advertising Service Ltd.
The Quaker Oats Company 136
Rogers & Smith Advertising
Charles Richards & Son Ltd. 182
Longleys & Hoffman Ltd.
Schlumberger Surenco 105
Rives, Dyke & Company
Seismograph Services Ltd. 29
Watts-Payne Advertising, Inc.
Sydney Smith & Sons Ltd. 35
S. H. Wright & Co. Ltd.
Socony Vacuum Oil Company, Inc. 15
Compton Advertising, Inc.
South Durham Steel & Iron Co. Ltd. 117
Tully-Crabbe Ltd.
Peter Spence Ltd. 147
Standard Oil Company of California 196
Batten, Barton, Durstine & Osborn, Inc.
Standard Oil Company of New Jersey 131
McCann-Erickson, Inc.
Standard Vacuum Oil Company 23
Sam J. Gallay Advertising
Stewarts & Lloyds Ltd. 143
H. Raymond Morgan
Stothert & Pitt Ltd. 179
Sun Shipbuilding and Dry Dock Co. 2
Doremus-Eshleman Co.
Telegraph Construction & Maintenance Co. Ltd. 166
G. Street & Co. Ltd.
Temperature Ltd. 182
Timken Roller Bearing Company 47
Batten, Barton, Durstine & Osborn
The United Steel Cos. Ltd. 45
Rowlinson-Broughton
Universal Oil Products Co. 12-13
Marsteller, Gebhardt and Reed, Inc.
Henry Vogt Machine Co. 48
Farson, Huff & Northlich
Vokes Ltd. 185
Crane Publicity
Vokes (Genspring) Ltd. 152
Crane Publicity
Warren Petroleum Corporation Cover II
Chapman Advertising Company
G. & J. Weir & Co. Ltd. 176
Scottish Industrial Adv.
Westinghouse Electric International Company 49
National Export Advertising Service, Inc.
George Wimpey & Co. Ltd. 162
Worthington Corporation 11
James Thomas Chirurg & Co.
Wyatt Metal and Boiler Works Cover IV
Wallace Davis & Co.
Zwicky Ltd. 168
Scottish Industrial Adv.

Matching the machine and the need

HOLMAN LEADERSHIP IN PNEUMATIC TOOL DEVELOPMENT

Unceasing research and experiment have enabled Holman Bros. to develop many new and effective applications of compressed-air power to the needs of Industry — particularly the Petroleum Industry Pneumatic Tools made in Camborne, England, can be seen at work in many world-famous refineries, shipyards, railway and motor-car plants, as well as civil engineering enterprises. In nearly every branch of engineering, new needs have brought new and improved Holman Pneumatic Tools.

★ *Full particulars of all Holman Pneumatic Tools gladly sent on request.*

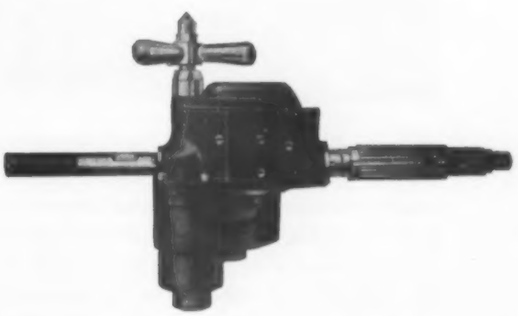


TUBE EXPANDER MOTORS

High-efficiency tools specially designed for oil refineries, steam-raising plant, power stations, etc. Powered by vane-type air-motor, and built to endure heavy shock loads. Full range of square chucks.

ROTOGRINDS

New Series—with interchangeable motors. Complete range of precision grinding and heavy-duty tools for internal grinding, cleaning castings, polishing, buffing, scaling, fettling, etc. Simple, efficient, smooth-running, quiet. Straight and grip handles supplied. The range includes **Rotobrushes.**



ROTODRILLS

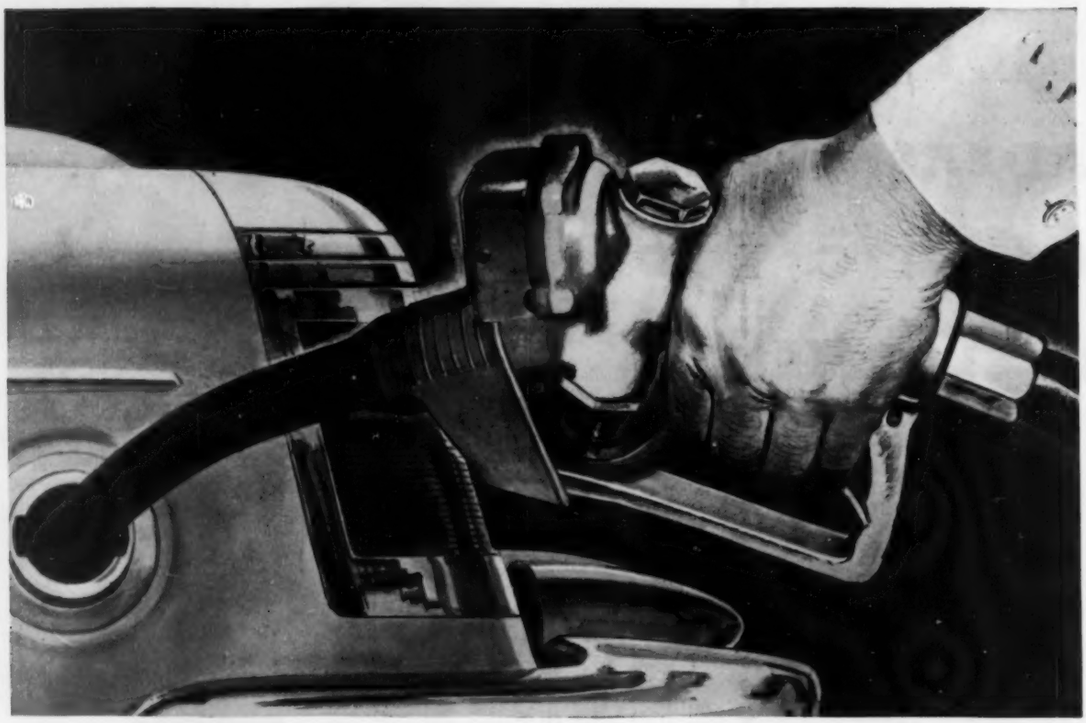
New Series — with interchangeable motors. Simply constructed, robust and free from vibration. Automatic lubrication. Reversing mechanism gives equal power in either direction, and a stalled drill can be restarted at once.

Holman

HC20

HOLMAN BROS. LTD., CAMBORNE, ENGLAND • 'Phone: Camborne 2275 (10 lines) 'Grams: Airdrill, Camborne

Here's one place where today's dollar goes further



In the fondly-remembered time of the nickel trolley and the 25¢ T-bone, gasoline for dad's 1925 model cost about 18¢ a gallon (excluding taxes). Sounds like a bargain—yet it really cost *more* than today's gasoline. The reason is clear when you keep this fact in mind: You fill your car's tank with gasoline, but what you're actually buying is *mileage*. Naturally, you'd rather pay $1 a gallon for gas that gave you 100 miles a gallon than buy 10¢ gas that delivered only 5 miles to the gallon. And that's why today's gasoline costs less than motor fuel of 1925 . . . it gives you *more miles to the dollar*. Research by companies such as Standard Oil Company of California has improved gasoline spectacularly over the years. This better motor fuel made more efficient auto engines possible, and together they give you up to 50% better mileage than motorists got in the '20's. On top of that, competition between oil companies has helped to hold down gasoline prices. Since 1925, they've risen only 20% (excluding taxes) while food has gone up 70%, clothing 63%, and the cost of living 53%. Compared to practically anything else you buy, gasoline is still a bargain. Any way you look at it, your money goes further when it goes for today's finer gasoline that gives you more miles to the dollar.

STANDARD OIL COMPANY OF CALIFORNIA

75 years of planning ahead to serve you better

Sunset AT 3-BAR RANCH

Day after day through the years gas produced from oil wells on the 3-Bar Ranch in Andrews County, West Texas, will be gathered, compressed, processed, and reinjected into the producing formation — resulting in the production of many hundreds of thousands of barrels of otherwise unrecoverable crude oil, the extraction of millions of barrels of liquid hydrocarbons from the gas, and the availability for markets in future years of a large dry gas supply.

Hudson designed and constructed the plant in collaboration with Stanolind Oil and Gas Company. Stanolind operates the plant and shares in its ownership with Humble Oil and Refining Company, Champlin Refining Company, and the Superior Oil Company.

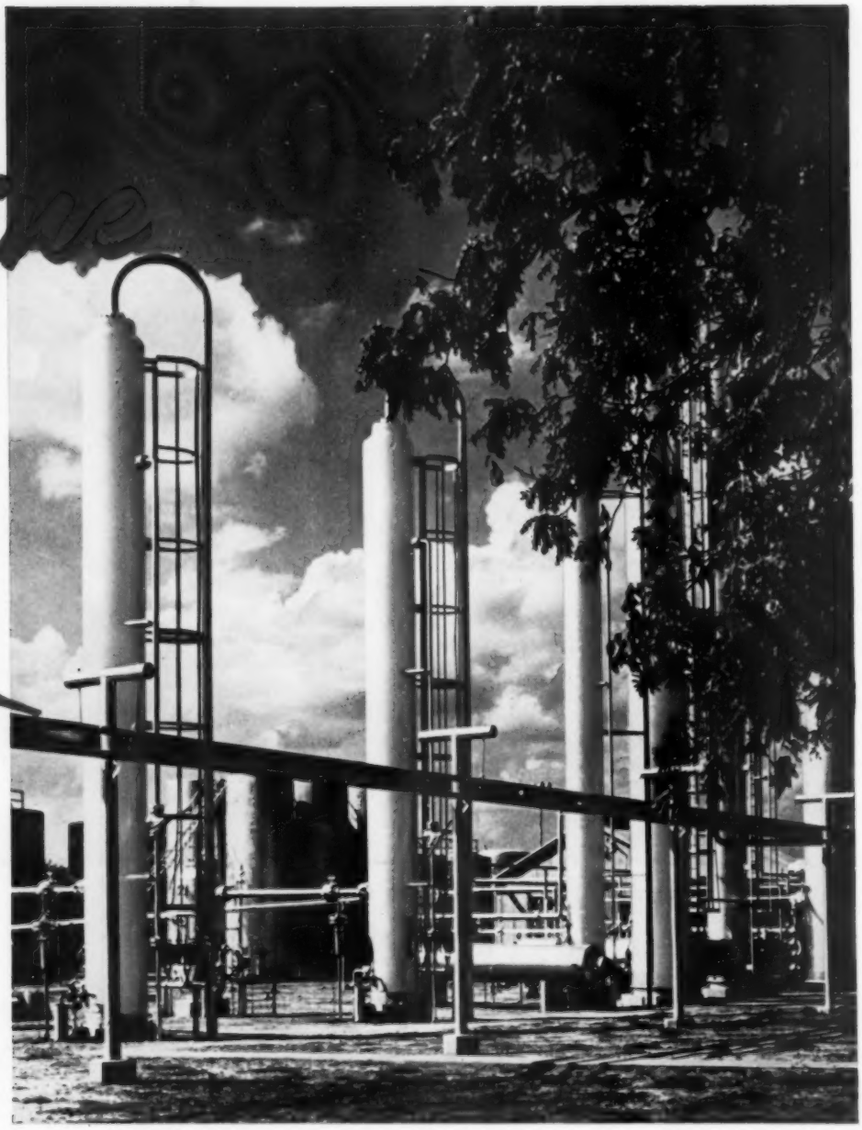
The facilities are designed to compress casinghead gas to a reinjection pressure of 2,700 pounds per square inch, and to recover from the gas heavier hydrocarbons which are fractionated into liquid products.

Designers and Constructors of Oil and Gas Processing Plants

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

Skyline by Wyatt



Whenever the oil search comes up with a major strike of condensate, recovery must take place on the spot and the industry widens its processing skyline by calling for the skill of Wyatt fabrication.

Wyatt's
HOUSTON-DALLAS-NEW YORK-TULSA

MANUFACTURERS AND ERECTORS SINCE 1913